SURGERY OF THE CAECUM AND COLON

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SURGERY OF THE CAECUM AND COLON

BY

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E & S LIVINGSTONE LTD

EDINBURGH & LONDON

1954

To
MY WIFE

Printed in Great Britain

PREFACE

TEXT books devoted to the study of the large intestine are rare amongst English publications and one confined to the surgery of the caecum and colon has not previously appeared Yet with the increasing incidence of diseases of these regions and the expanding scope of surgery in their treatment the need for such a monograph concerning them would appear to be a real one and it is hoped that the pages which follow may fill a genuine gap on the over burdened bookshelves of medical literature

The surgery of the caecum and colon is rightly within the province of the general surgeon It is not a speciality in the accepted sense of the word Nevertheless the reward of a study more intimate than is usual of the anatomy and pathology of the colon and of the surgical techniques peculiar to this part of the body is great The incidence of recurrences following excisions for cancer will be reduced the mortality associated with the most extensive resections will become minimal and with these extensive resections carried out either for malignant or benign conditions the patient will usually be spared the burden of an artificial anus There can be few realms of surgery in which the final results are more satisfying not only to the patient but to the surgeon as well

The work has deliberately excluded a study of disease and surgery peculiar to the rectum as this part of the large intestine has been dealt with by other authors Some overlap however is inevitable as the disease processes in the colon may involve the rectum or excision of the latter may in certain instances constitute a part of the planned treatment of a condition affecting the former These relevant aspects of rectal surgery are therefore described

In this monograph particular attention has been paid to the step by step description of operative technique as it is upon this that success finally depends The work is planned so that little cross referencing is required should the surgeon wish to refer to the operative technique referable to any particular condition Slight repetition of description is unavoidable in attaining this objective but the overlap is minimal

Detailed descriptions of the signs symptoms and diagnosis of the various diseases have been included and pre and post-operative treatment has been discussed extensively It is hoped therefore that this volume may prove of value not only to the house surgeon in his care of the patient but to the pre and post graduate medical student seeking a knowledge of the subject more extensive than is given in the general surgical text book

The surgical techniques described are those used in the day to day practice of the author In addition they represent largely the practice of the surgical staff of the Gordon Hospital They are methods which although at times deviating from common usage have been proven to be safe and satis factory and which are we consider preferable

It is a pleasure to thank my many colleagues and friends for the way in which they have helped me in this work To Mr Lawrence Abel with whom as teacher chief and colleague I have been associated for nearly twenty years much of my knowledge of this subject is due From his great wisdom

and experience I have fully drawn in my own work Mr E Crook Mr M Smyth Mr R Raven and Mr K James my other surgical colleagues at the Gordon Hospital have allowed me free use of their records and photographs Dr P Flood has helped me in the selection of the X ray reproductions

Dr C B Lewis, who is responsible for the chapter on anaesthesia has anaesthetised most of my cases including all of those who have been desperately ill Our low mortality rate is in no small part due to his skill To Dr J Earle I am indebted for the chapter on the pathology of tumours of the colon and for his advice and help in the case difficult in histologic diagnosis

Any contribution on familial polyposis of the colon would be of little value without the association of Dr Cuthbert Dukes His kindness and help on all occasions I now have the opportunity to recognise and I am particularly in debt to him and to his publishers for allowing me to reproduce the family tree of a patient who came under my care Mr Lloyd Davis has allowed me to publish the photograph of a patient upon whom he performed an abdomino perineal excision for extensive haemangioma of the rectum and lower colon

The cases of ulcerative colitis have all been treated in association with Dr E Cullinan Surgical success in this field can only be achieved by the closest co-operation between physician and surgeon and this happy association has existed at the Gordon Hospital The method suggested for the surgical treatment of this condition may seem controversial Yet a happier and more contented group of patients treated by the methods advocated it would be hard to find

The part played by Dr M Bodian in the study of the problem of Hirschsprung s disease is world wide in its recognition and I am fortunate indeed that he and his publishers have given me permission to publish photo graphs of the condition

Dr P Hansell in charge of the photographic department of the Westmister Hospital has prepared the many other black and white and colour photographs His help and advice has been great Miss J Fairfax Whiteside and Miss M Hawker have been responsible for the vast majority of the drawings The beauty and detail of their work I think will be acknowledged

Some of the specimens photographed are from the shelves of the Westminster Hospital Medical School Museum and I am indebted to Professor Pulvertaft for allowing me to use them The photomicrographs in Chapter II were prepared by Mr L A Towles to whom my thanks are also due I would like to express my deep appreciation to the sisters and nursing staff of the Gordon Hospital No patients could have been nursed better and it is to their care and to that of my registrars and housemen particularly Mr Gordon Ramsay the Senior Registrar to the hospital that success has often been due

Finally I would like to thank my publishers for their kindly help and for the way in which they have produced this book

STANLEY AYLETT

114 Harley Street
London 1954

CONTENTS

CHAPTER I

SURGICAL ANATOMY AND PHYSIOLOGY OF THE LARGE INTESTINE

SURGICAL ANATOMY

THE large intestine comprises all parts of the bowel which lie distal to the ileo-caecal valve It consists therefore of the caecum with its vermiform appendix the ascending colon and the hepatic flexure the transverse colon leading through the splenic flexure to the descending colon the pelvic colon the rectum and finally the anal canal It is not within the province of this monograph to consider those diseases affecting the rectum and anal canal alone but as these structures may be involved in disease processes affecting the colon so that their excision may be necessary the essential points in their anatomy are considered The vermiform appendix and its diseases are not discussed

Developmental Anatomy Certain aspects of the early development of the colon must be noted if subsequent abnormalities dependent upon irregularities of this stage of its formation are to be understood

After the fifth week of intrauterine life the epithelial lining of the primitive small intestine is known to undergo proliferation so that its lumen becomes obliterated Recanalisation of the cell masses takes place however in the ensuing weeks so that by the end of the twelfth week a lumen is restored and the intestine has taken on its final form It is almost certain that a similar process of luminal obliteration followed by a like period of recanalisation takes place in the colon and that incompletion of the latter stage is responsible for those rare cases in which congenital stenosis or atresia of the colon are found

The caecum the ascending colon the hepatic flexure and the greater part of the transverse colon are developed from a part of the primitive mid gut which in the early embryo communicates with the yolk sac As a result of the relatively large size of the developing liver in the 8 mm embryo there is insufficient room in the coelomic cavity for the accommodation of the whole of the primitive gut and the mid gut is extruded into the umbilical cord Here covered by amnion it remains until about the tenth week during which time important developmental changes occur

The cephalic half of the mid gut lies to the right of the caudal portion and undergoes great elongation becoming coiled in the process to form the jejunum and a part of the small intestine At this stage a bud appears in the caudal loop which is to develop into the caecum and its site of origin marks the junction between the large and the small intestine the distal portion of

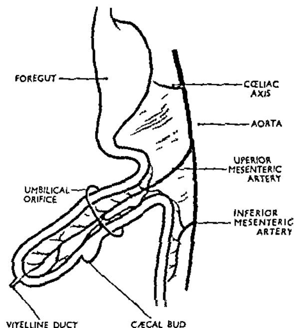


FIG 1
Diagrammatic representation of the mid gut in the embryo of eight weeks The caecal bud is shown in the caudal half of the extruded bowel

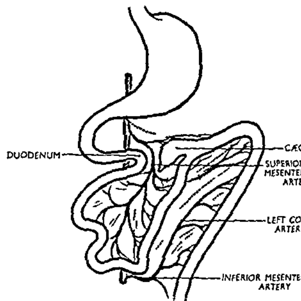


FIG 2
Diagram to illustrate the initial stages of the rotation of the mid gut The caecum is here placed in the left hypochondrium

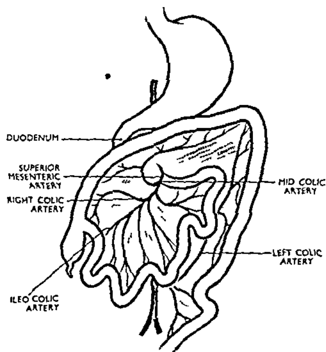


FIG 3
The rotation of the caecum completed In its course to reach its final position it has passed superficially to the superior mesenteric artery and to the duodenum

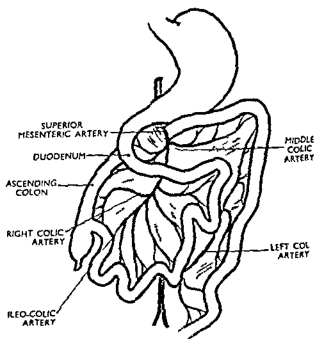


FIG 4
Reversed rotation of the mid gut in which the caecum has passed posteriorly to the superior mesenteric artery and to the duodenum

the latter therefore arising from the caudal loop of the mid gut (Fig 1) The vitello-intestinal duct during this process becomes separated from the extruded mid gut and is absorbed so that the intestine now lies free in the umbilical cord Meanwhile the distal part of the vitelline artery that accompanied the duct also disappears its proximal portion remaining as the superior mesenteric artery or artery of supply of the mid gut

By the tenth week of intrauterine life the coelomic cavity has so enlarged and the relative size of the liver so diminished that the former is able to accommodate the extruded gut The return of the intestine to the abdominal cavity then commences

This return is a complicated process and the caecum does not pass directly to the right iliac fossa Instead it ascends to the left upper quadrant of the coelomic cavity and then passing to the right crosses over the upper part of the small intestine and the superior mesenteric artery Finally it descends down the right side of the abdomen to the right iliac fossa (Figs 2 and 3) In this process of rotation the ascending and transverse colons both of the same derivation follow the normal mesenteric attachments maintaining them in their final position

This complicated rotation of the caecum may not be completed and the process may be arrested in the upper part of the abdomen when the organ lies over the distal part of the duodenum Fibrous bands passing over the latter structure tether the viscus in this position and both these and the caecum itself may so press upon the duodenum that an obstruction may be produced In other cases the abnormal mesenteric attachments associated with the incomplete rotation may result in the formation of a volvulus and the two forms of obstruction can co-exist Rarely the caecum—instead of passing in front of the superior mesenteric artery—passes behind it and this abnormality of position may well give rise to obstructive symptoms after birth (Fig 4)

Abnormalities of fixation of the caecum in the right iliac fossa may in adult life be productive of a volvulus

General Anatomy The caecum and the colon are readily distinguished from the small intestine in that the fibres of the longitudinal muscle coat are largely concentrated into three definite bands As the colon merges with the rectum this arrangement is once more lost and the fibres gradually spread out to provide a uniform and complete covering to this portion of the large bowel

In the caecum the ascending colon and the descending colon these bands or taeniae are placed one on the anterior surface of the bowel and one on each of the sides On the transverse colon the taeniae occupy the superior anterior and postero inferior aspects and in the pelvic colon the lateral medial and the mesenteric positions except in its lower part where they spread out and merge to form the uniform longitudinal muscular coat of the rectum

When the taeniae are dissected from the underlying colon it is found that their length is somewhat less than a foot shorter than the bowel to which they are attached This discrepancy in length serves to pucker the colon so that it normally appears segmented In certain inflammatory conditions such as ulcerative colitis the resulting contraction of the wall of the bowel diminishes its length so that the haustrations become lost and in a barium enema X ray the bowel appears as a featureless tube

Suspended from the wall of the caecum and of the colon throughout its length are small peritoneal saccules containing varying amounts of fat They are most marked in the obese individual and are more prominent in the pelvic colon than elsewhere Arranged in two approximately parallel rows on either side of the anti mesenteric border of the bowel they often surround and hide any diverticula that may be present Moreover their presence tends to limit the spread of any infection that may occur in the latter The appendices epiploicae are occasionally excessively pedunculated and can become twisted with resultant strangulation In operations on the colon they are of value in that they serve as a useful reinforcement of any suture line

The Caecum and Ascending Colon The **caecum** lies in the right iliac fossa above the outer part of the inguinal ligament Normally it is covered by peritoneum in its entirety so that it has a considerable degree of mobility The posterior layers of peritoneum connecting it to that of the posterior abdominal wall however are usually short so that it has no real meso caecum but in some 15 per cent of cases this is present and extensive Such a meso caecum gives to this part of the bowel a very abnormal mobility and a volvulus may occur In another 6 per cent of bodies the peritoneum covering its posterior aspect is absent in which case the viscus lies in direct contact with the ileopsoas muscle and the femoral nerve

The caecum is naturally a baggy organ and capable of enormous degrees of distension when the bowel distal to it is obstructed Sometimes it may fill completely the lower right half of the pelvis (Fig 5)

The caecum merges into the **ascending colon** a little above the point of entry into it of the small intestine and this part of the colon extends to the hepatic flexure It is normally covered by peritoneum on the anterior lateral and medial aspects only though occasionally it is provided with a complete meso-colon Posteriorly it rests upon the iliacus muscle the quadratus lumborum and at its upper part the lower pole of the right kidney The ureter and the spermatic vessels lie behind the peritoneum on its medial aspect and if the normal colon is mobilised after incision of the peritoneum on its lateral margin these structures usually remain attached to the posterior abdominal wall Sometimes they may become attached to the fibro fatty tissues on the posterior aspect of the colon so that when the latter is mobilised and brought out of an abdominal incision they too may be drawn upwards and in such cases will require dissection to prevent their damage

The Hepatic Flexure This forms an abrupt bend between the ascending and the transverse colons and passes downwards and forwards to merge into the latter Anteriorly it lies under cover of the inferior surface of the right lobe of the liver and posteriorly uncovered by peritoneum it is in contact with the kidney before crossing the second part of the duodenum From the latter it is separated by a thin layer of areolar tissue only and great care must be taken during its mobilisation prior to resection to avoid injury to the duodenum



FIG 5
Straight X ray of the abdomen from a case suffering from obstruction of the pelvic colon The enormously distended caecum with a fluid level is shown occupying the right half of the pelvis

The Transverse Colon The transverse colon passes between the hepatic and splenic flexures It is provided with a meso-colon which at its midpoint is of considerable depth so that it is suspended in a wide curve the lowest part of which often descends below the level of the umbilicus As the meso colon approaches the flexures at either end its depth rapidly diminishes until for the last inch or so it is non-existent The proximal part of the transverse colon is therefore in contact posteriorly with the second part of the duodenum and the head of the pancreas a light layer of areolar tissue alone intervening Its anterior relations are the inferior surface of the liver and the gall bladder

The distal end of the transverse colon lying behind the stomach is separated by areolar tissue only from the inferior surface of the tail end of the pancreas

The great omentum covers the bulk of this portion of the colon to which it is loosely attached In the normal transverse colon these attachments can be separated without cutting across any vessels and as soon as this separation has been achieved the great omentum and the stomach may be lifted upwards and forwards to expose the superior layer of the transverse meso-colon In disease of the transverse colon however the omentum becomes closely fixed to the bowel and its separation without considerable haemorrhage is impossible

The Splenic Flexure The distal portion of the transverse colon runs upwards backwards and to the left to merge with the splenic flexure the latter bending acutely downwards to run into the descending colon This flexure is not easily accessible as it lies at a higher level than that of the opposite side and deeply under the costal margin It is covered by peritoneum on all but its posterior aspect and its upper curve lies in close contact with the basal triangular surface of the spleen From its upper part a triangular condensation of peritoneum with superior and inferior surfaces and a free anterior border passes upwards and inwards to the diaphragm opposite the eleventh rib This is the phrenico colic ligament and requires deliberate division in the mobilisation of the splenic flexure

The Descending Colon This descends downwards and medially and then vertically downwards until it passes into the pelvic colon at the inlet of the pelvis It is normally covered with peritoneum only on its anterior lateral and medial aspects but occasionally a complete meso-colon is present Posteriorly at its upper end it lies in contact with the diaphragm and the outer and lower part of the kidney Lower down it is in relation to the muscles of the posterior abdominal wall lying firstly in the angle formed by the psoas and the quadratus lumborum but later crossing the former to join the pelvic colon The ureter lies well medial to the descending colon but as in the ascending colon it may become adherent to the fibro fatty tissue that is drawn up into the wound during mobilisation of this part of the large intestine when it will require gentle dissection to prevent its injury In its lowest part the femoral and genito-curral nerves are direct posterior relations

The Pelvic Colon The pelvic colon extends from the lower end of the descending colon at the inner border of the psoas magnus to the front of the second or third sacral vertebra where it becomes continuous with the rectum It is provided with a deep meso-colon the base of which is reflected on to the peritoneum of the posterior abdominal wall in the form of an inverted V The upper limb of this extends from the inner border of the psoas muscle upwards and inwards to the midline crossing in its course the common iliac vessels and the ureter Here angulating sharply it is continued into the lower limb which passes down in front of the sacrum

From this short base the meso-colon fans out so that the length of the bowel is usually many times that of its base of attachment Averaging about fifteen inches long it may be as short as five inches or as long as twenty five inches (Cunningham 1951) Because of its great length compared with that of the base of the meso-colon the extremities of which are fairly close to each other twists of the colon in this part of the bowel are not uncommon

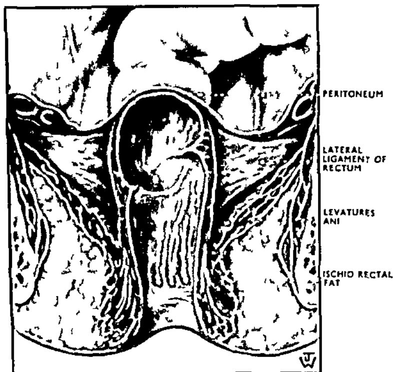


Fig 6
Section of the lower part of the pelvis and rectum to show the lateral ligaments lying between the periton eum and the levatores ani muscle

The Rectum This continues the colon from the level of the lower point of attachment of the pelvic meso-colon to the anus It passes downwards and slightly backwards then directly downwards and finally downwards and slightly forward where penetrating the pelvic diaphragm it joins the anal canal In most of its course it lies in the hollow of the sacrum its convexity being directed backwards but in the concavity of its lowest part lies the ano-coccygeal body

In addition to the curves in an antero posterior direction the rectum also contains three placed in the lateral plane The upper and lower of these curves have their convexities directed towards the right and the middle one to the

left In the concavities of these curves the rectal wall is infolded into the *lumen of the rectum giving rise to shelf like projections known as the valves of* Houston

The upper third of the rectum is covered in its entirety by peritoneum In the middle third the posterior aspect loses this covering and below this

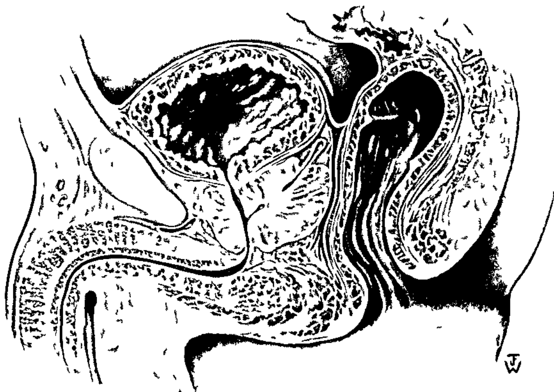


FIG 7
Section of the pelvis to show the anterior relations of the rectum in the male The recto vesical septum is shown in blue

level where in front the peritoneum is reflected on to the bladder in the male or on to the uterus in the female and on to the side walls of the pelvis laterally it is devoid of any peritoneal coat

On either side of the rectum below the peritoneal reflection between it and the lateral wall of the pelvis is a space loosely filled with areolar tissue but also containing the lateral rectal ligaments (Fig 6) These are condensa tions of the inward expansion of the pelvic fascia which passing in front and behind the rectum and attached to it by fibro fatty tissue afford to it some degree of support In the ligaments run branches of the middle haemorrhoidal artery which supply this part of the intestine In carrying out a resection of the rectum these ligaments have to be cut through deliberately on either side

Posteriorly the upper part of the rectum is loosely bound down to the fascia covering the sacrum from which it is easily separated by blunt dissection Its other posterior relations are the left pyriformis muscle the left sacral plexus the coccyx and the levatores ani muscle Above the coccyx the fascia covering the anterior aspect of the sacrum is reflected forwards and is attached to the posterior aspect of the rectum at this level This reflection is well defined and strong and is known as the fascia of Waldeyer Following the removal of the coccyx during the perineal stage of an abdomino perineal excision of the rectum this fascia has to be incised before the surgeon s fingers can be passed into the cavity of the pelvis to withdraw the bowel which has been separated from above

Anteriorly the upper part of the rectum covered by peritoneum is in direct relation to the bladder or to the uterus although in the pouch of peritoneum between the two structures coils of small intestine are often present When the reflection of the peritoneum from the anterior surface of the rectum is incised in the male the upper part of the rectovesical septum comes into view (Fig 7) This sheath of the pelvic fascia attached below to the perineal body lies between the rectum posteriorly and the bladder seminal vesicles and prostate anteriorly At its upper limit it is reflected on to the superior surface of the bladder The fascia is separated from its anterior relations by loose areolar tissue but to the rectum behind it is closely attached In dissecting the rectum therefore it is necessary to incise this fascia transversely just below the peritoneal reflection so that the plane of cleavage between it and the bladder seminal vesicles and prostate can be identified If the surgeon should inadvertently dissect in the wrong place and attempt to strip the recto-vesical fascia from the anterior surface of the rectum profuse haemorrhage will result

The Anal Canal The anal canal is one and a half inches in length and is the terminal portion of the large intestine Its course is downwards and backwards Anteriorly are the perineal body and the triangular ligament the former separating it from the vagina in the female and the bulb of the corpus spongiosum in the male (Figs 8 and 9) Laterally the anal canal is supported by the fat of the ischio rectal fossa and posteriorly by the ano-coccygeal body Surrounding the canal are the internal and external sphincters and at its junction with the rectum the pubo rectalis muscle circles its lateral and posterior walls

The Perineal Body This is a fibro-muscular mass more marked in the female than in the male Anteriorly it is attached to the bulbo-cavernosus muscle and behind the superficial portion of the external sphincter muscle gains insertion into it From each side the superficial transverse perineal muscles and from above some of the fibres of the levatores ani muscle also pass to their insertion into its body The free margin of the base of the triangular ligament merges with perineal body

In carrying out the perineal part of an abdomino perineal excision of the rectum the perineal body is transected and separated from its anterior and lateral muscular attachments

The Ano Coccygeal Body This is a fibro muscular body situated in the concavity of the lowest part of the rectum between it and the coccyx

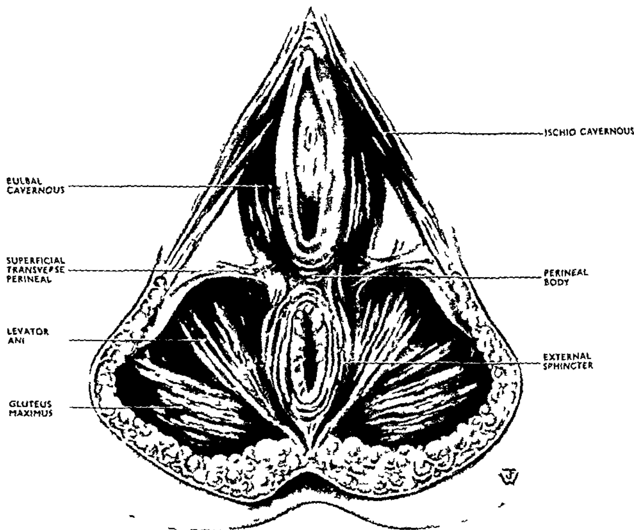


Fig 8
The muscular anatomy of the female perineum

The Levatores Ani Muscle This muscle forms a diaphragm to the pelvis through which the rectum passes to join the anal canal It arises along a line stretching from the pelvic surface of the pubic bone to the pelvic surface of the ischial spine the intervening origin between the bony regions being from the obturator fascia The fibres run downwards inwards and backwards It is

possible to distinguish two distinct parts of the levatores ani muscle the **pubo coccygeus** and the **ileo-coccygeus** The former arises from that part of the line of origin of the muscle which lies anterior to the obturator canal and is itself arranged in three parts The anterior fibres pass backwards at the sides of the prostate or vagina to be inserted into the perineal body The most

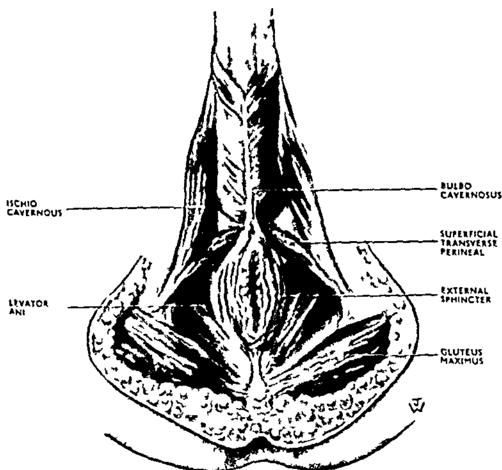


FIG 9
The muscular anatomy of the male perineum

posterior fibres run backwards and medially overlapping in their course those of the ileo-coccygeus to gain attachment to the ano-coccygeal body and to the sides and anterior aspect of the coccyx

From a surgical point of view the third section of the pubo-coccygeus is of the greatest importance These muscle fibres arise from the back of the symphysis pubis under cover of those of the anterior part of the pubo-coccygeus and are known as the **pubo rectalis** muscle They pass backwards around the rectum the fibres from each side becoming continuous with those of the opposite side behind this structure which is thus drawn forwards as in

a sling (Fig 10) The muscle fibres of the pubo rectalis are intimately concerned with the maintenance of continence and if they are divided incontinence will result in spite of the integrity of the internal sphincter In operations which involve anastomosis of either the ileum or the colon to the ano rectal region this structure must therefore be meticulously preserved if continence is to be retained

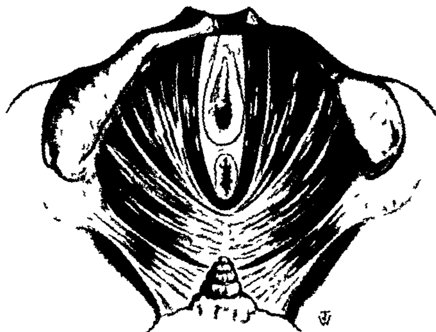


FIG 10
The levatores ani muscle complex viewed from below The important pubo rectalis portion slinging the rectum forwards is shown in red

The ileo coccygeus is the posterior portion of the levatores ani muscle and arises from the posterior part of the line of origin behind the obturator canal It is inserted into the ano-coccygeal body and into the coccyx under cover of the pubo-coccygeus

The Ileo Caecal Valve At the junction of the ileum with the caecum the former appears as if it were invaginated into the large intestine although the whole thickness of the wall of the small gut is not included in this process The peritoneal and longitudinal muscular coats of the terminal ileum continue smoothly into the corresponding layers of the caecum and therefore serve to maintain the invagination of the remainder of the wall

Viewed from the caecum the valve appears as a mammillary eminence on the summit of which is the opening into the small intestine It is probable that when the caecum is distended the lips of the valve are stretched thus closing its aperture and tending to prevent backward regurgitation of the content of the large intestine

Blood and Lymphatic Supply of the Colon The vascular supply to the colon is illustrated by Figure 11 As it is the distribution of the vessels and their accompanying lymphatics which determine the extent of radical excision in cancer of the colon considerations of their surgical anatomy is detailed in Chapter IV when the theoretical basis of these operations is discussed

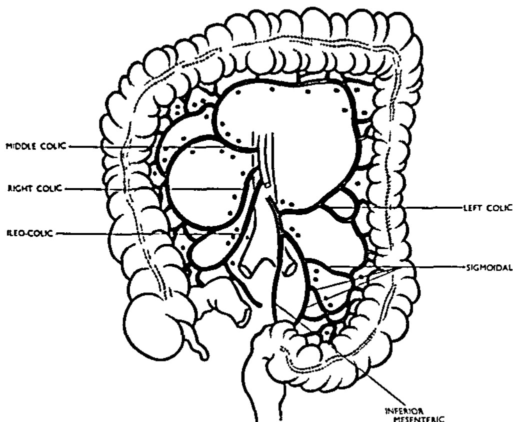


FIG 11
The arterial anatomy of the colon

Nerve Supply The large intestine has both sympathetic and parasympathetic innervation The sympathetic fibres which reach the bowel from the coeliac the superior and the inferior mesenteric plexuses are post ganglionic Although largely following the course of the blood vessels many fibres pass directly to the bowel wall

The parasympathetic fibres arise partly from the vagal nerve and partly from the second and third sacral nerves and in their course to the colon are intimately associated with the sympathetic nerve fibres They are preganglionic and arborise with the cells of Auerbach and Meissner situated in the muscular and submucous coats of the intestine

The sympathetic is inhibitory to large intestinal contractions with the exception of the sphincter area to which it is stimulatory whereas the para sympathetic has an opposite effect

PHYSIOLOGY

The intestinal content enters the large intestine through the ileo-caecal valve in the form of a semi fluid chyme and is evacuated through the anal canal as a solid of firm but varying consistency This marked change in the consistency of the faeces in its passage through the colon is largely due to the water absorbing properties of this part of the intestine and in the normal subject it is the right half that is mainly responsible for this function The left side of the colon is concerned with the storage of the intestinal content so that defaecation can be delayed in accordance with the dictates of the higher centres and with its onward propulsion and expulsion at those times of election

In order that water absorption shall be adequate irregular waves of muscular contraction take place in the caecum ascending colon and proximal part of the transverse colon These serve to maintain the faecal content in this part of the bowel until by churning it and by bringing all parts of it into contact with the mucosa water absorption is completed Cannon in 1902 was the first to avail himself of X rays introduced in 1896 in order to study the movements of the colon Then and subsequently (1911) he noticed waves of anti peristalsis apparently starting at the site of a tonic ring of contraction which drove the intestinal content backwards into the caecum from the trans verse and ascending colons This continued for some hours after the meal had reached the caecum Elliott and Barclay Smith (1904) carried out a study of colonic movements and in general their results were a confirmation of those of Cannon but using the cat for experiments they noticed that the waves of anti peristalsis were occasionally observed in the distal portions of the large intestine as well In further animal experiments it appeared that the type of peristalsis in the proximal colon seemed to be determined by the consistency of the intestinal content When the contents were soft anti peristalsis pre vented their onward progress but as water absorption became completed and the faeces hardened this diminished giving place to normal peristaltic waves

Larson and Bargen (1933) carried out animal experiments in which balloons were inserted into various levels of isolated large intestine the varia tions of pressure being recorded by kymographic tracings By these they showed that the caecum was constantly contracting whereas for the duration of the experiment *the distal part of the colon was almost completely inactive*

In man the onward passage of faecal material from the right to the left side of the colon normally takes place in response to a gastro-colic reflex which is initiated after each meal is taken As a result of this the intestinal content reaches the pelvi rectal junction but normally does not enter the

rectum until the co-ordinated act of defaecation is set up. The infrequency of this reflex therefore allows the ileal content to remain in the caecum and ascending colon for a time sufficient for most of its water content to be absorbed.

Although there is no doubt that in the intact colon water absorption is largely carried out in the right side, most of this function is quickly undertaken by the remaining portion of the large intestine if a right hemicolectomy is performed. Following such an operation there is never any concern with regard to the water balance of the patient and the number of bowel actions rapidly return to one or two in each twenty-four hours, the faeces being well formed though somewhat softer than normal. Similarly the right side of the colon is well able to act as a store for the faeces where the left side has been removed, so that frequency of bowel action again does not follow a left hemicolectomy except in the initial stage of convalescence.

With the exception of the secretion of mucus which by a purely mechanical process aids the onward transmission of the faeces, the colon has little other physiological function. It can absorb glucose and saline so that in milder cases of depletion of these substances they may be introduced by this route. It was thought that a considerable part of the calcium and magnesium salts and of iron ingested with the food was excreted by the large intestine, but the work of Nicolaysen (1937) and McCance and Widdowson (1938) have disproved this.

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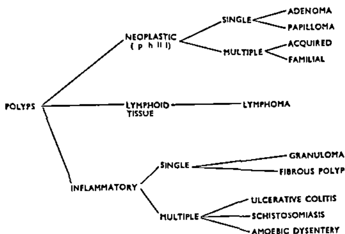
CHAPTER II

THE PATHOLOGY OF TUMOURS OF THE COLON

JAMES H O EARLE

POLYPS

THE term ' polyp " is one which in relation to the colon is used by the surgeon to refer to any pedunculated lesion Pathologically a wide variety of conditions are embraced by this term including true epithelial tumours and inflammatory lesions The various non malignant polypoid lesions may be classified as follows —



As well as these lesions mentioned above there are other non malignant tumours which however present more as protuberant lesions rather than polyps These are the connective tissue tumours lipomas fibromas leio myomas (which may present as a polyp) implantation cysts and endometriosis

The commonest lesions are the true epithelial tumours the adenomata and papillomata The other tumours and lesions are comparatively rare

Papilloma The papilloma has a villous structure the fronds being covered by a columnar celled epithelium similar to that lining the large intestine (Fig 12A and B) These growths tend to obtain a large size without necessarily undergoing a malignant change Sometimes they tend to remain flat and spread diffusely involving a large area of mucosa (Fig 13)

They are usually heavily infected as would be expected from their structure There is consequent lymph node enlargement of a reactionary nature which *at operation may give a false impression of malignancy*

The papilloma is probably a much slower growing tumour than the adenoma and symptoms tend to become apparent before a malignant change



A



B

FIG 12A and B
Microphotographs of two early papillomas
(A × 17 B × 19)

has occurred Gabriel (1948) quotes Dukes as stating that approximately 10 per cent of operation specimens show definite evidence of an origin in a villous papilloma

Adenoma An adenoma first becomes apparent as a flat sessile growth a few millimetres in diameter gradually enlarges and as it does so tends to develop a pedicle of normal mucosa due to the traction which is exerted upon it (Fig 14)



Fig 13
Benign papillomatous tumour which has arisen *from a large area of mucosa The tumour* has remained sessile

The surface is usually lobulated and has a distinct reddish colour Histologically they are composed of a solid mass of acini lined by mucus secreting columnar celled epithelium In some instances the acini become markedly distended by the secretion of mucin Infection is not so common as in the papillomas but can in association with mechanical trauma give rise to histological changes in the surface cells which may present difficulty to the inexperienced in their differentiation from an early malignant change

Dukes (1947) puts forward a hypothesis for the difference in structure between a papilloma and an adenoma of the colon He suggests that the neoplastic stimulus whatever it may be acts either at the base of a mucosal crypt or on the free mucosal surface In the former instance due to the



FIG 14
Pedunculated polyp which by traction has drawn out a long stalk of normal mucosa (× 6)

confined space free dichotomous growth is impossible and the glandular structure of an adenoma results whilst in the latter case dichotomy is free to occur and a branched frond like papilloma is produced In practice many polyps show a mixture of both papillomatous and adenomatous structure

The vast majority of adenomas and papillomas occur in the pelvic colon and rectum and they are frequent precursors of carcinoma The diagnosis of a malignant change in such a tumour in this region presents a problem in treatment Higher in the colon laparotomy and local resection can be employed in certain cases but in the lower bowel a decision has to be made between local removal through the sigmoidoscope and abdomino perineal excision with its social burden of a permanent colostomy

The extent of the tumour spread within the stalk of the polyp and its degree of malignancy may help in the choice of the surgical treatment to be adopted Two papers have recently been published dealing with this subject the first by Fisher and Turnbull (1952) the second by Lockhart Mummery and Dukes (1952) They have adopted a very similar method of classification of the carcinomatous change although using slightly different terminology Fisher and Turnbull used for their diagnosis of malignancy the criteria of Sevinton and Warren (1939) Mummery and Dukes describe six different stages —

1 Mucus secreting adenoma

2 Proliferating adenoma with zones of active proliferation but not amounting to a malignant change

3 Carcinoma *in situ* in which there are microscopic foci of carcinoma but no evidence of infiltration

4 Focal carcinoma resulting from fusion of the microscopic foci to form a larger lesion although still confined to the mucosa

5 Invasive carcinoma with a free margin *i e* the stalk of an adenoma is now invaded but there is ample free margin between the area of invasion and the colonic mucosa

6 Invasive carcinoma involving colonic mucosa or submucosa

They go on to state that the treatment would appear to depend on two factors firstly the grade of malignancy which they rate as low average or high and secondly the extent of the spread

It is very doubtful if *in situ* cases of high grade malignancy can ever be successfully treated by local excision although this is probably adequate for those of low or average grade malignancy

In invasive carcinoma those of high grade malignancy will obviously need radical treatment but in those of other grades much will depend on whether the polyp has been removed with a tumour free margin

This study is of importance for it may mean the possibility of eradicating the disease in these cases without employing a major operative procedure All such local excisions of adenomas will need a very careful and prolonged follow up

Adenomas of Childhood These tumours are seen during the first decade of life They contain a large amount of fibrous tissue stroma and are infiltrated by numerous eosinophils which have been held by some authorities to represent part of an allergic process Eosinophils are however so commonly found in such a wide variety of intestinal lesions that it would seem unnecessary to attach a special significance to them in these adenomas These tumours are invariably benign

Multiple Polyposis This condition which is nearly always familial will be described in association with the malignant tumours (p 25) as an important precancerous condition Histologically the lesions are typical adenomas Occasionally a papilloma may occur amongst the adenomas

Inflammatory Polyps These must be distinguished from pseudopolypi which consist of oedematous detached surviving mucosal remnants present in an area of ulceration They may project into the lumen of a sigmoidoscope during examination thus simulating a true polyp Histologically they consist of irregular pieces of mucous membrane

The true inflammatory polyp is a rounded pedunculated lesion very similar to a true adenoma in its appearance but usually paler in colour due to fibrous tissue production Histologically they are composed of mucous membrane and granulation tissue As the fibro-blastic reaction increases they tend to become composed of a central core of fibrous tissue covered by mucous membrane They may then be referred to as a fibrous polyp A similar end result may be achieved in a rectal haemorrhoid Such a lesion may slough off from the colon wall leaving a small shallow ulcer which rapidly heals over

Sometimes a small adenoma like lesion is found to consist entirely of granulation tissue and to be covered with mucous membrane only at the edges with an attempt at epithelialisation by a flattened columnar epithelium over the remainder of its surface Such lesions bleed easily They probably result from an excessive production of granulation tissue in a small ulcer

Lymphoma This is largely a lesion of the rectum but it can occur in the pelvi rectal region They are mentioned here largely because of the importance of their differentiation from the malignant tumours of lymphoid tissue which may involve the colon as part of a generalised disease

Lymphoma of the rectum was first described by Shattock in 1890 Since then there have been various accounts of these tumours amongst which are those of Greig (1909) Dukes (1934) Miller (1948) Li (1948) and Heller and Homer (1950) Their importance lies in the recognition of their benign behaviour despite what at times is a disturbing histological picture resembling lymphosarcoma Macroscopically they present as polypoid tumours which may measure as much as 8 0 cm in diameter The main mass of the tumour lies in the immediate submucosal tissue (Fig 15) and by pressure may cause atrophy of the overlying mucosa and disruption of the muscularis mucosae There are no sinusoids present the structure being purely follicular There is

no enclosing capsule as in a lymph node and at the periphery there is often an appearance of cellular scatter into the surrounding tissues This together with mitotic figures gives a picture which at times it is difficult not to regard as malignant However the absence of other lesions and a normal blood picture together with subsequent history of non recurrence are factors which establish these tumours as benign in nature

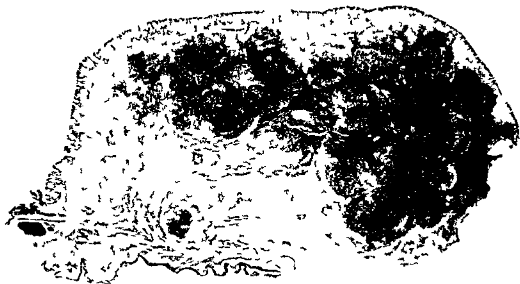


FIG 15
Lymphoma of rectum (× 4)

Opinion varies as to whether these lesions are truly neoplastic or inflammatory in origin The majority favour the former view

CONNECTIVE TISSUE TUMOURS

Lipoma These tumours in the large intestine have no distinguishing histological features from other lipomata except that they are covered by intestinal mucosa Weinstein and Lieberman (1935) collected twelve cases

Fibroma A true fibroma of the large intestine would seem to be a great rarity Berk writing in Bockus Gastro-enterology (1944) mentions them and refers to a paper by King (1917) in which reports of five large intestinal cases were collected out of a total of fourteen cases in the whole gastro intestinal tract Gabriel in his book on rectal surgery makes no mention of these tumours apart from those occurring as the result of fibrosis following repeated attacks of thrombosis and strangulation in a haemorrhoid

Leiomyoma These tumours occur throughout the length of the gastro intestinal tract being most common in the stomach and rare in the large intestine

Golden and Stout (1941) in an excellent account of these tumours reported six cases in the colon and rectum Lumb (1951) reporting on leiomyoma of the intestinal tract presenting as large cystic masses had no such cases in the colon

According to Golden and Stout 50 per cent of the smooth muscle tumours of the large intestine occur in the caecum and consequently obstruction is an exceptional complication Also the overlying mucosa is seldom ulcerated in this site In the rectum they are nearly all within reach of the examining finger and are covered by an intact mucosa

Microscopically the tumours are composed of bundles of spindle shaped cells with a tendency to interlace or in some instances to show palisading making differentiation from neurilemmoma difficult unless fixation has been good and myofibrils can be demonstrated They are not well-encapsulated tumours and may merge with the surrounding muscle layers

There is difficulty in assessing a malignant change in these tumours and from a histological standpoint their behaviour is often unpredictable Bizarre cell structure may well result from degenerative changes to which these tumours are prone Lemon and Broders (1942) suggested that the finding of mitotic figures was sufficient proof of malignancy However this statement is open to criticism as cases occur in which there is very little difference from normal smooth muscle fibres and yet metastases have been produced

Golden and Stout do not use the term leiomyosarcoma but prefer the use of the terms leiomyoma and malignant leiomyoma the latter diagnosis not always being purely histological but one that takes into account the subsequent behaviour of the case

The prognosis of these cases depends much upon their sites Those in the colon together with stomach jejunum and ileum are restrained by the peritoneum for a considerable time so that their complete removal is possible and the prognosis good In the duodenum rectum and retroperitoneum their removal is difficult and the incidence of recurrence high

Angioma These are very rare tumours of the colon They vary in size from small capillary naevi to very large cavernous haemangiomas involving a considerable extent of the bowel wall A good account is given by Bensaude and Bensaude (1932) In dealing with the smaller lesions the possibility of a local manifestation of Hereditary Haemorrhagic Telangiectasia should be kept in mind

The microphotograph (Fig 16) shows a submucosal angiomatoid lesion of the colon which at one point had an ulcerated surface and caused the patient a young man of twenty years to have a severe haemorrhage necessitating blood transfusion Microscopically the lesion comprises a bunch of malformed thick walled vessels in a markedly collagenous matrix The possibilities of generalised disease was considered in this case including polyarteritis nodosa but there was no substantiating clinical evidence at the

time and the patient has remained well and free from symptoms since the local removal of the lesion over two years ago



FIG 16
Submucosal angiomatoid lesion of the colon (× 12)

IMPLANTATION CYSTS

Dukes (1929) described the pathology of these cysts of the colon and rectum and drew attention to their relation to previous operations at the site of their occurrence Mucosa may become buried either by sutures or over growth of granulation tissue with the result that continued mucus secretion gives rise to a localised cyst

ENDOMETRIOSIS OF THE COLON

Endometriosis of the colon is a part only of the condition now called endometriosis externa The term implies the development of endometrial tissue in sites other than the uterus including the uterine adnexia the

pouch of Douglas the pelvic peritoneum the recto-vaginal septum the umbilicus and the small intestine The site incidence of endometriosis decreases as the proximity to the uterus decreases There has been much discussion as to the mode of origin of these ectopic foci and there appear to be three main hypotheses

Sampson (1921 1922) put forward the theory of retrograde menstruation and the deposition *via* the Fallopian tube of viable endometrium into the pelvic cavity The second theory is that of heterotropic development in the coelomic epithelium and is supported by the majority who oppose Sampson s theory Halban s (1924) theory of embolic spread of endometrial tissue *via* the lymphatics is not widely accepted According to Novak (1947) the tendency is now towards an amalgamation of the first and second theories

The ectopic endometrium is similar in structure to the normal tissue and is subject to the same hormonal influence Thus with each menstrual cycle there is proliferation and haemorrhage If the intestinal mucosa is intact over the lesion the blood is retained forming cystic spaces As a consequence the adjacent tissues undergo fibrosis which may result in stricture of the colon If there is ulceration of the mucosa then there is rectal bleeding associated with the menstrual cycle

These lesions of endometriosis externa have been referred to by some as endometrioma They are not however true neoplasms but misplaced normal endometrial tissue which still responds to hormonal influence and which will regress at the time of the menopause Mikulicz Radecki as reported by Pessel (1946) believes that many patients with colonic and rectal involvement are erroneously operated upon as cases of carcinoma

Finally it is perhaps as well to bear in mind in differential diagnosis those rare cases of mixed tumours of the uterus which by their clinical course have proved to be malignant and also those in which the stroma plays a dominant part in the tumour formation and which behave like sarcomata (Willis 1953)

An excellent account of endometriosis with special reference to the intestinal tract is given by Macleod (1946)

MALIGNANT TUMOURS OF THE COLON

CARCINOMA

INCIDENCE The large intestine is one of the commonest sites of carcinoma and in some countries its incidence approaches that of carcinoma of the stomach The majority of the cases fall in the latter half of the sixth decade (Hayden and Shedden 1930 Dukes 1940) It tends to occur at a somewhat earlier age in women than in men The incidence in men is about twice as great as in women (Dukes 1940) Those cases associated with familial intestinal polyposis tend to occur in an earlier age group and succeeding



A



B

Fig 17

A Showing numerous satellite adenomas in the region of a carcinoma of
B Microphotograph of small polyp in region of carcinoma (× 10)

generations in any one family tend to develop their polyposis and thus their cancer at an earlier age than their parents (Dukes 1952)

SITE INCIDENCE In the large intestine as a whole the heaviest incidence is in the rectum The pelvic colon is the next most frequent site followed by the caecum with the lowest incidence at the hepatic and splenic flexures

CAUSATION In the majority of cases of carcinoma of the large intestine no causative factor can be established Two associations are however significant one with adenomas and papillomas the other with familial polyposis which left to itself will always terminate with one or more carcinomas

An investigation into familial polyposis and its relation to cancer was instigated in 1925 by Lockhart Mummery at St Mark s Hospital and since then this work has been carried on by the surgical staff and by Dr C E Dukes at that hospital This has culminated in the publication of the findings in forty-one families (Dukes 1952) the members of which have suffered with this disease

The average age of onset of the disease is twenty years Thus it is the tendency to hyperplasia which is inherited and the disease is not congenital Cancer develops in cases of familial polyposis some fifteen years after the onset of the first symptom *i e* some twenty years earlier than in those cases *not associated with the disease As a rule the later the onset of the polyposis* the longer the interval before malignant change supervenes so that some of these cases may die of other causes before cancer has developed

Occasionally cases of multiple polyposis with or without cancer are seen in which at the time of interrogation there is no apparent familial history These cases should not be classified as non familial until a thorough investigation of the family has been carried out and a sufficient period of time allowed for suspect members to develop symptoms

ASSOCIATION OF CARCINOMA AND POLYPS A high percentage of carcinomas of the large intestine especially those of the rectum and pelvic colon will on examination be found to be accompanied by one or several satellite polyps Stewart (1931) found polyps present in 27 per cent of seventy nine autopsy cases and Dukes (1926) reported twenty five of thirty three consecutive cases of rectal and pelvic colon carcinomas accompanied by polyps Anyone examining a large number of operative specimens of large intestine carcinoma cannot help being struck by the very high incidence of associated polyps In fact if the specimens are always stretched out on frames as described later it is seldom that at least two or three pin head size adenomas cannot be found *In some cases the polyps are sufficiently* numerous to raise a suspicion that these cases are in fact familial in nature (Fig 17A and B) but usually the polyps are clustered around the carcinoma and the more distant mucosa appears normal

In some cases the carcinoma can be seen arising in part of a polyp Swinton and Warren (1939) demonstrated an origin from polypi in 14 per

cent of their cases of carcinoma of rectum and colon These appearances suggest that a zone of bowel mucosa has undergone a generalised neoplastic change which may progress to malignancy in one area (Fig 18)

RELATION TO ULCERATIVE COLITIS Attention in this country has recently been drawn to chronic ulcerative colitis as a disease predisposing to cancer of the colon and rectum (Fig 19) Counsell and Dukes (1952) have reviewed the literature on this subject and have reported thirteen new cases of cancer



FIG 18
Carcinoma arising in association with a papilliferous polyp (× 8)

following this disease They draw attention to the significant fact that whilst the incidence of carcinoma in series of cases previously reported varies from 0 per cent to 5 per cent when the long standing cases are considered alone the incidence is much greater and in one series was as high as 36 per cent

In the St Mark s series of sixty three surgically treated cases of chronic ulcerative colitis the cancer incidence was 11 1 per cent but if those cases who had had the disease for ten years or longer were considered separately the incidence was nearly 50 per cent

From their studies Counsell and Dukes conclude that chronic ulcerative colitis predisposes to cancer of the rectum and colon and that the percentage of malignancy recorded in any series will vary with the severity of the disease its duration the age of the patient the period of observation and the experi ence of the observer

It should be noted that cancer associated with ulcerative colitis is usually of the colloid or mucoid type Often it does not present as an obvious macroscopic growth and its presence may be revealed only by a careful histological study of stenosed areas of the bowel As Counsell and Dukes point out the prognosis of carcinoma complicating ulcerative colitis is very poor

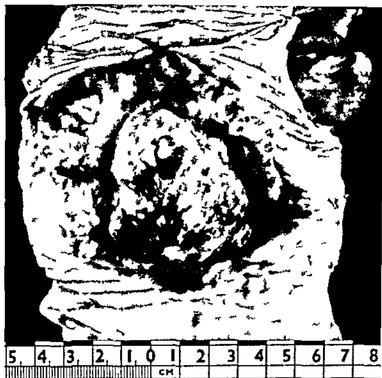
RELATION TO OTHER INFLAMMATORY LESIONS There seems no evidence that diverticulitis amoebic or bacillary dysentery schistosomiasis or other granulomatous lesions *predispose to carcinoma of the large intestine*

CARCINOGENIC AGENTS It was pointed out by Dukes (1945) that there might be some relation between ingested material and carcinoma of the large intestine Willis (1953) also deals with this subject No carcinogenic agent has yet been identified but there is scope here for further investigation

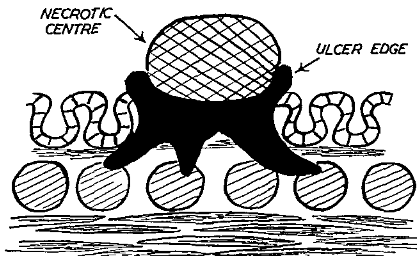
MACROSCOPIC APPEARANCES Carcinoma of the colon may be either protuberant ulcerating or stenosing The protuberant variety consists either of a firm rounded growth or of a papilliferous structure The commonest form is the ulcerated growth with a hard raised everted edge Such ulcers vary in sizes from a few to eight or nine centimetres in diameter often completely encircling the bowel wall Some authorities believe that the solid protuberant type and the ulcerating type are quite distinct but it would seem probable that the latter is only a later stage of the former which has undergone central necrosis and sloughing This process is well demonstrated in the accompanying photograph (Fig 20)



FIG 19
Post mortem specimen of the descending and sigmoid colon from a female aged forty years Ulcerative colitis had been present for fifteen years The sigmoid colon shows a heavy infiltration with colloid carcinoma with extensive spread outside the bowel



A



B

FIG .0A and B

A protuberant type of carcinoma of the colon the centre of which is in the process of sloughing away to leave a typical ulcerated lesion A diagram of this process is shown below the specimen

The stenosing or annular type of growth is often comparatively small in bulk but infiltrates right round the bowel wall giving it a distinct waisted appearance

MICROSCOPY GRADING AND CLASSIFICATION These tumours are all adenocarcinomas Several attempts have been made to achieve a satisfactory method of their grading Dukes (1937) adopted Broders' method using four grades Grinnel (1939) reporting on an extensive study of a series of cases of rectum and colon finally adopted three grades His grade I and II correspond to Broders' I and II whilst his grade III incorporates Broders' III and IV

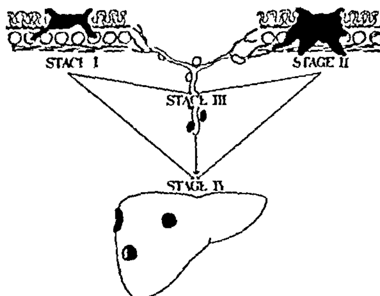


Fig 21
Diagrammatic representation of the four stages in the classification of large intestine cancer
Stage I Tumour confined to bowel wall No lymph node metastases
Stage II Tumour penetrates bowel wall No lymph node metastases
Stage III Either I or II with lymph node metastases
Stage IV Either I II or III with distant metastases

At the Gordon Hospital we have used Grinnel's grades but termed them low average and high as these terms are descriptive and avoid confusion with the method of classification Dukes' method of classification which is quite independent of the histological grading is based upon the extent of the spread of the tumour at the time of operation It is divided into four stages set out in diagrammatic form below (Fig 21)

It is rare to find lymph node involvement before the bowel wall has been penetrated It is also unusual to discover involvement of veins by malignant thrombi in the absence of lymph node involvement

Grinnel in his series found that in the colon the incidence of Grade I cases was 19 per cent higher and Grade III cases 16 per cent lower than those cases in the rectum suggesting that generally speaking the colon tumours tend to be better differentiated than those in the rectum This is certainly our own impression

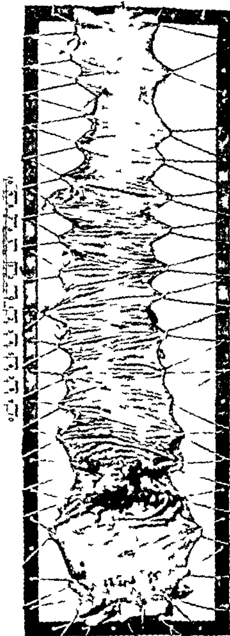


Fig 12
Metal frame with specimen stretched out

In addition in the same author s series the percentage of Stage III cases in the colon was half that of those in the rectum In the colon 34 per cent of cases were Stage I whilst these formed only 18 per cent of cases in the rectum If the right colon is considered separately the proportion rises to 44 per cent of Stage I cases

The distribution of the colloid and mucoid carcinomas is approximately equally distributed between the right colon the left colon and the rectum They form some 12 per cent of all cases of carcinoma of the large intestine These cases are not graded or classified as their behaviour has proved unpredictable Usually however they behave in a highly malignant manner It is interesting to note that whilst increasing malignancy is usually associated with increased loss of function by the cell the cells in these cases are functioning even to excess

Dukes (1940) showed that the prognosis of a case could be related to its grade of malignancy While this is undoubtedly true a more accurate prognosis is obtained from the Dukes method of classification (Gabriel Dukes and Bussey 1935) Grading is an estimate only of the expected rate of growth of a tumour and routine histology is examined from a very limited field The tumour is graded according to its most malignant component and unless a thorough examination were made in each case there is the possibility that a false impression might be given by examining only an area where differentiation is good

The classification of cases is based on the extent of the disease at the time of operation and is consequently more accurate although a judicious application of both grading and classification gives the best assessment

FIXATION DISSECTION AND REPORTING OF INTESTINAL SPECIMENS The grading and classification of large intestine cancer requires good fixation For this purpose there must exist a close liaison between the operating theatre and the laboratory At the Gordon Hospital the specimens are sent immediately upon removal to the laboratory The specimen is opened up along its anterior or anti mesenteric border and washed in normal saline It is then sewn out on a specially made metal frame and placed in a tank of formol saline (10 per cent) for twelve to twenty four hours (Fig 22)

The specimen is then cut from the frame and photographed A line drawing is now prepared and as the lymph nodes are dissected they are charted each lymph node being numbered and handled individually Special carriers have been designed containing thirty six small compartments each taking one lymph node These carriers are then taken through the alcohols to the waxes and the lymph nodes blocked separately The growth is outlined on the line drawing remembering that as the latter represents the serosal surface of the bowel the drawing must be a mirror image of the actual growth Histology is taken from the growth preferably from several different areas Any thrombosed veins should also be sectioned as these may contain tumour cells When the histology of the lymph nodes has been examined those containing tumour cells are blacked in and the drawing photographed The print of the specimen and the drawing are then mounted side by-side (Fig 23)

A report form on the following lines is then attached to the photographs —

Macroscopic appearance

(1) Length of resected specimen

(2) Distance of growth from edge of resection (either upper or lower) In rectal cases this is taken from the ano rectal line

(3) The type of growth Its measurements and the amount of bowel circumference it occupies

Microscopic appearance

(1) Grade of malignancy

(2) Extent of local spread

(3) Lymph node involvement

(4) Venous involvement

Classification

Stage I II III or IV

ARGENTAFFINOMA

Argentaffinoma is the term used to describe that tumour which arises from the Kultschitsky cells It is also known as a carcinoid argentaffin carcinoma or Kultschitsky-cell carcinoma

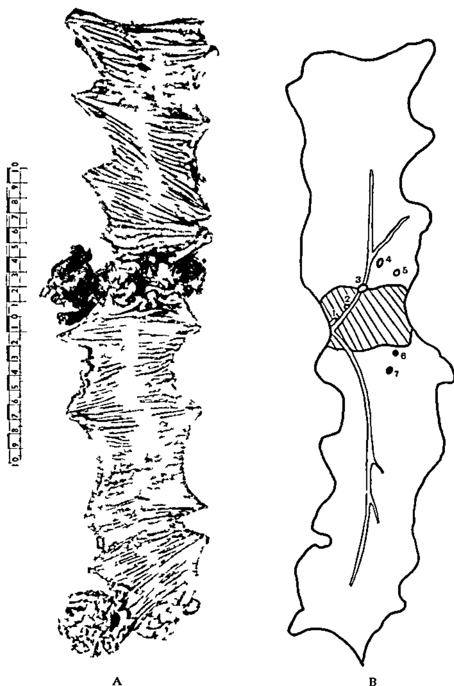


Fig 23a and b
Specimen and line drawing

Such tumours occur throughout the length of the gastro intestinal tract In the appendix they are slow growing and usually give rise to symptoms before they metastasise In the colon and the small intestine they tend to be annular constricting growths commonly metastasising to local lymph nodes and to the liver In the rectum they usually present as sessile pedunculated tumours clinically resembling an adenoma Gabriel Dukes and Bussey (1951) state that these tumours are not uncommon in the rectum but they have not met with one that could not be removed by local excision and they have had no recurrences

Good reviews of cases including those occurring in the colon and the rectum are given by Stout (1942) Erlich and Hunter (1947) and Raven (1950)

SARCOMA

Sarcoma of the colon is a very rare tumour In the experience of Dukes and Bussey (1947) they constitute less than 0 5 per cent of all large intestine tumours They are lobulated and covered by an intact mucous membrane which however may ulcerate as a result of trauma or pressure They may be lympho-sarcomas or reticulo-sarcomas and the possibility of a generalised disease must always be considered

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CHAPTER III

CANCER OF THE COLON—ITS EARLY SYMPTOMATOLOGY AND DIAGNOSIS

THE EARLY SYMPTOMATOLOGY

CANCER of the colon the site distribution of which is shown in Figure 24 gives rise to symptoms at a relatively early stage in its development The mass projecting into the lumen of the bowel soon becomes capable of interfering with the regular passage of faeces whilst its deeper roots infiltrating into the wall of the colon and destroying its nervous plexi interrupt the normal co-ordinated waves of peristalsis still further In addition ulceration of its surface is usually rapid and the resultant discharges of blood and mucopus which reach the exterior mixed with the stool or alone may be marked enough to be noticed by the patient

So often however these early symptoms pass unheeded and the patient accustomed to the vagaries of the bowel and indoctrinated by advertisement with the concept that all men have piles attributes these and other early abnormalities to some such trivial lesion Even when the sufferer reports for medical advice these symptoms are still not always recognised as those of early colonic cancer and the patient and his doctor in over 30 per cent of cases continue in this false paradise of piles for a further three months or more The average period of delay amongst this 30 per cent between the time when advice is first sought and that when operation is undertaken is over five months so that on occasions it may be more than a year after the initial symptom appeared before the patient is finally operated upon and by such time the disease has become widespread

Over 10 000 men and women die in England and Wales each year of cancer of the colon They are not all at the end of their allotted span of years and the disease though most common above the age of fifty is by no means rare in the early forties and occurs though uncommonly at earlier ages The disease is no respecter of class and rich and poor aristocrat and artisan are equally affected Its only preference is for the male in whom the disease is twice as common as in the female There is thus a large and mixed field amongst whom the recognition of the early stage of this disease is possible and the reward of such a diagnosis lies in the excellent prospects of cure unassociated with any residual disability that radical surgery has to offer

Until public education in cancer is further advanced it is impossible to eliminate the delay that occurs between the onset of first symptoms and the day on which the patient first reports to his doctor But further prevarication

is avoidable and if those early symptoms and signs described in detail below are always thought of as being due to cancer of the colon until the possibility of such a lesion has been excluded earlier diagnosis and improved results will be achieved

Although some symptoms and signs are commoner in lesions of the right side of the colon and others in lesions of the left absolute distinction is not always possible They are therefore considered as those of carcinoma of the colon as a whole and where they are more predominant in disease of one or other side attention is drawn to this fact

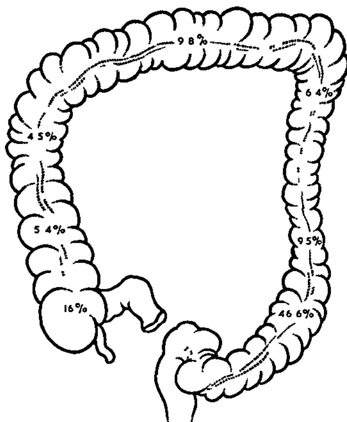


FIG 24
The site incidence of cancer of the colon

Changes of Bowel Habit In Ransom s (1939) series of cases of carcinoma of the right side of the colon such changes were present in 50 per cent of patients and in our own series on the left side over 90 per cent reported alterations in bowel habit It is to be expected that in right sided lesions the majority of which are confined to the caecum and the ascending colon these changes would be less marked because the more fluid nature of the stool and the larger lumen of the parts affected make a mechanical obstruction less likely until an advanced stage of the disease has been reached In lesions of the left side of the colon however as the result of a comparatively small

growth considerable obliteration of the bowel lumen takes place and this combined with the increasingly solid nature of the faeces at this level results in the greater prominence of this symptom

These alterations in bowel habit are often slight and the classic marked and obvious symptom of alternating diarrhoea and constipation is a late one and a symptom of impending obstruction not of early carcinoma In most patients constipation is the change observed necessitating perhaps the use of purgatives where none have been used before or an increase in the amount required where they have been in previous use Less commonly periodic attacks of diarrhoea often attributed by the patient to some dietetic cause may be the only symptom to suggest a lesion in the colon and these changes may be revealed only on direct questioning so little has he or she been concerned with them

The question Have you had any change whatsoever in your normal bowel habit? is one that should be addressed to all patients whenever a lesion of the colon is under consideration Several patients have noticed an alteration in the habitual time at which the bowels have acted a routine after breakfast evacuation being replaced by an action at later times during the day Others record a feeling of incompleteness of the act of defaecation and of a constant desire to have their bowels open symptoms of course characteristic of rectal carcinoma but occurring as well in growths of the pelvic colon A few will sometimes comment that the size of the stool has become less and they may liken their own to rabbit droppings or describe them as ribbon like **Any change in the normal bowel habit, however slight if repeated or persistent, or occurring in conjunction with any of the other symptoms of carcinoma of the colon, should be regarded with suspicion and a full investigation of the patient carried out**

Bleeding The presence of blood in the faeces is a symptom which is more commonly observed by patients suffering from disease of the left colon than by those in whom the lesion is on the opposite side Bleeding takes place equally readily from the surface of any ulcer but on the right side unless it is sudden and severe the semi fluid nature of the faeces allows such free admixture of blood and intestinal content to take place that its presence is not obvious to the patient during defaecation Person and O Neill (1950) state that in 80 per cent of their cases of carcinoma of the right colon blood was found in the stool on chemical examination yet only about a quarter of these patients had themselves noticed any bleeding In our series over 70 per cent of those patients whose lesion was on the left side of the colon reported bleeding as an early symptom

The bleeding may be sudden and brisk due to an erosion of a vessel in the bowel wall of some size so that the patient may have the urge to defaecate and will notice that blood alone has been passed Often the blood is bright red in colour and the symptom may too easily be attributed by patient and clinician to the presence of haemorrhoids The blood however usually

darkens with successive evacuations and an observant patient may notice that it is smeared over the surface of the stool This information is rarely volunteered by the patient but if asked for is frequently given A positive observation is of considerable importance as in the bleeding from haemor rhoids generalised streaking of the stool is seldom present

Sometimes the bleeding is so slight that smearing of the stool with blood is the only symptom noticed by the patient and it alone may bring him to his doctor So easily then the haemorrhage may be attributed to the presence of piles especially if as is so often the case these are also present Case 1 is an example of such a patient

Case 1 H S Male aged forty six first noticed that the stool was smeared with blood on several occasions during one week in April 1951 He reported to his doctor and was treated with pile ointment The bleeding cleared up but was noticed again one month later when the ointment was repeated He now observed that his bowels which for years had been opened immediately after breakfast had become delayed in their action until late in the morning or early in the afternoon This information however was not volunteered to the doctor nor was it asked for The patient started to lose weight and in spite of several attendances on his practitioner marked attacks of diarrhoea had supervened before he was referred for a surgical opinion Sigmoidoscopy confirmed the clinical diagnosis of cancer of the colon

The blood may not be present on every occasion on which the bowels are opened Indeed following its initial appearance weeks may pass before once again its presence is observed and the period of freedom from this symptom may serve further to convince both patient and clinician of the triviality of its cause

Other patients may notice blood or blood stained mucus in the toilet pan or on the paper at most acts of defaecation and in some the passage of wind has been accompanied to the patient's dismay by soiling of the underclothes with blood

Finally the bleeding may be present as a black tarry stool and the suspicion of a bleeding peptic ulcer may be aroused Detailed questioning of the patient and further investigation will reveal the cause of the haemor rhage In our experience close questioning of the patient who complains of bleeding at stool and who has subsequently been shown to have carcinoma of the colon has always revealed other symptoms often of a minor nature but nevertheless suggesting the diagnosis of his disease

Reference has been made to the masking of the presence of blood in the faeces due to the free admixture that takes place when the lesion is placed high up in the colon but the constant ooze that may occur from the surface of such an ulcer can give rise to severe degrees of anaemia

Anaemia Symptoms of anaemia may bring the patient to the clinician especially when the lesion is in the right side of the colon In such cases severe blood loss may have occurred without its presence in the stool having been noticed He may complain of tiredness and fatigue breathlessness and

noticeable pallor and where no other cause is present to explain such symptoms carcinoma of the bowel must be considered Lahey (1939) states that there appears to be no parallel situation in malignancy where such severe grades of secondary anaemia can be present with the lesion still readily operable and the patient within a stage where radical removal can result in non recurrence' Case 2 exemplifies such a patient

Case 2 S I Female aged thirty nine attended the casualty department in September 1947 complaining of giddiness breathlessness swelling of her ankles and pain in her chest The symptoms had been noticed with increasing severity over the previous month On questioning she stated that she had noticed increasing constipation for three months but on several occasions in the same period had had attacks of diarrhoea No blood or mucus had been noticed in the stool although direct questioning revealed that during one attack of diarrhoea a tarry motion had been passed There had been no abdominal pain Examination revealed a large mass in the caecum

Pain Severe pain is not characteristic of an early carcinoma of the left side of the colon and only occurs when a neoplasm has extended through the wall of the gut so that the latter becomes adherent either by malignant infiltration or by inflammatory reaction to the parietal peritoneum or to nerves in close proximity to the area of gut involved Nevertheless in the early stages of the disease patients often experience a sense of abdominal discomfort or fullness sometimes described as a dragging or nagging pain from which the patient is seldom free In carcinoma of the descending or pelvic colon the pain is usually sited diffusely across the lower abdomen and is not localised to the left side Such patients often best describe their symptoms by stating that they feel as if they want to hold the lower part of the abdomen in order to give support to that region

Lesions involving the left side of the colon sometimes produce distension of the caecum and discomfort and pain localised to the right iliac fossa is not uncommon in patients suffering from a cancer at this level Pain of an easily recognisable colicy type is also met with This is due to a transient obstruction to normal faecal passage with some temporary distension of the gut above the site of the neoplasm resulting in increased peristaltic activity The observant patient may notice that during these attacks the abdomen is distended and feels blown up symptoms that are rapidly relieved with a bowel action or the simple passage of flatus

In lesions of the right colon and especially in those of the caecum pain may be the only symptom that has brought the patient to the doctor In Jarvis and Cayer s series (1947) it was the first indication of the disease in 74 per cent of their cases This pain is usually localised to the lower right quadrant of the abdomen and sometimes is so acute and severe that a diagnosis of appendicitis may be made

In other patients the pain may be associated with a palpable mass and if as is so frequently the case there is in addition a rise of temperature and an

darkens with successive evacuations and an observant patient may notice that it is smeared over the surface of the stool This information is rarely volunteered by the patient but if asked for is frequently given A positive observation is of considerable importance as in the bleeding from haemorrhoids generalised streaking of the stool is seldom present

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discomfort in the abdomen has caused the patient to palpate his or her abdomen but occasionally the mass is discovered accidentally usually when taking a bath

THE DIAGNOSIS OF THE DISEASE

From the start it must be emphasised that no investigation, especially when negative in its result takes precedence in the early diagnosis of this disease over detailed history taking and the physical examination of the patient The points of note when taking case histories have been recorded in the previous section and the importance of anaemia or obvious weight loss have been emphasised

Abdominal Examination Inspection of the abdomen may reveal a minor degree of distension and on palpation a distended caecum is sometimes identifiable Visible peristalsis is rarely seen in early cases but its presence should be looked for and if it is noticed in a reasonably well-covered patient that positive observation is a factor that may weight the final decision in favour of a neoplasm

Palpation may reveal a mass but in a patient of good physique a small growth lying high up in the flexures where the liver and the prominence of the costal margin make examination difficult may well escape notice Similarly in the pelvic colon an early neoplasm may not be palpable as the affected loop may lie in the hollow of the pelvis obscured by bladder or uterus Rectal examination in these latter cases especially if carried out bimanually will often reveal the presence of a mass where none has been obvious on abdominal examination

Rectal Examination We prefer to carry out this examination with the patient lying on his right side the examiner using his left index finger to pass into the rectum (Fig 25) Unless a colon growth has partially intussuscepted into the rectum direct palpation of the neoplasm will obviously be impossible on account of the limited length of the examining finger but it is often feasible to palpate a mass through the rectal wall especially if the free hand is palpating the abdomen at the same time and gently pressing the colon on to the finger in the rectum It is our experience that palpation of the neoplasm in this way is easier with the patient lying on his right side as the pelvic colon tends to fall on to the examining finger in the rectum instead of away from it as is the case with the patient lying on his left side

Apart from direct palpation of the growth the presence of a neoplasm may be suggested when rectal examination reveals gross ballooning of the rectum and the finger lies free and almost untouched by the rectal wall This ballooning of the rectum is probably due to an interruption of its nerve supply by involvement of the bowel wall at a higher level Finally a rectal examination is never complete until the clinician has observed the gloved finger on its withdrawal from the bowel The presence thereon of blood stained mucus or specks of blood will suggest a lesion in cases where no other abnormality has been discovered

increased leuocyte count an appendix abscess is simulated The diagnosis of a cancer may thus be delayed

Further delay in such cases results from the fact that with the *administration of antibiotics the febrile reaction settles* the leucocyte count diminishes and the actual size of the mass lessens In association with a cancer in the caecum or ascending colon there is often a marked inflammatory reaction the result of infection entering through the ulcerated mucosal surface of the bowel and the partial resolution of symptoms and signs following the administration of antibiotics is due to the control of this complication of the disease Two of our recent cases had been treated for three months as cases of appendix abscess before being referred for treatment of their cancers

General Symptoms It is difficult to explain the loss of weight and such symptoms as tiredness and lassitude loss of appetite and general well being without always an associated anaemia which are common though by no means constant complaints in patients suffering from colonic cancer These symptoms however may exist when bowel habit irregularities pass almost unnoticed by the patient It is probable that they are due to the passage of a semi liquid and highly toxic stool over an extensive area of ulceration resulting in the absorption of products of faecal decomposition

Other Symptoms An ulcerated surface in the bowel will of course give rise to a **mucopurulent discharge** and the patient may observe its presence in the stool In our experience however it has always been mixed with blood and unstained mucus discharge alone is a rare symptom of carcinoma of the colon In one case a medical practitioner the initial symptom appearing three months before bowel irregularities and the passage of blood caused him to report for investigation was the **excess passage of flatus**

The presence of a carcinoma involving the bowel wall and projecting into its lumen may occasionally be the starting point of an **intussusception** Symptoms of this condition may be the first indication of the disease and the apex of the intussusception can prolapse through the anal canal giving the impression of a prolapse of the rectum Case 3 is an example of this

Case 3 M C Female aged forty four sent for her doctor stating that she had had an attack of colic and on going to the toilet her bowel had prolapsed *and remained out She had had no other symptoms and on examination by the* doctor she was thought to be suffering from a prolapse A few hours later when examined by the author the bowel had returned On admission to hospital for investigation no evidence of prolapse was present A barium enema and sigmoido scopy were both negative On her history it was considered that the patient had *had an intussusception due to a growth benign or malignant* of the left side of the colon At laparotomy an early carcinoma of the pelvic colon was identified

Finally especially in carcinoma of the caecum the patients themselves may notice the **presence of a mass** in the abdomen and although other symptoms may have been present it is this finding that urges their first attendance on the doctor Interrogation will usually reveal that pain or



Fig 26
Filling defect due to carcinoma of the caecum



Fig 27
Obstruction to the flow of barium in a case of carcinoma of the hepatic flexure

Sigmoidoscopy Sigmoidoscopy after suitable colonic irrigation is the next step in the investigation These preliminary washouts may yield suggestive information if blood or blood stained mucus is observed in the returns Except in the very nervous patient sigmoidoscopy can be carried out without anaesthesia and it is usually performed in the out patient department Although the growth may be situated at a level beyond the limit

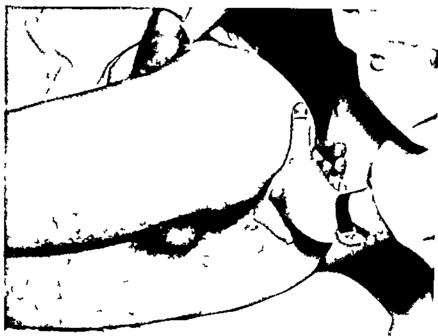


FIG 25
The bimanual examination of the patient in the right lateral position

of visualisation with the sigmoidoscope the presence of blood or discharge flowing from above will confirm the presence of abnormal pathology in the colon In other cases the ulcerated mass of the carcinoma may be seen and from it a biopsy is taken to confirm the diagnosis

Barium Enema X ray The next stage in the investigation is the barium enema examination which may reveal a filling defect in the colon (Figs 26 31) It is best however to leave the patient for a day or two until this is carried out as if performed within twenty four hours of a sigmoidoscopy the residuum of the air blown into the colon during this procedure may well interfere with the correct delineation and filling of the bowel with barium so that a lesion may then be suggested where none exists or a filling defect may be passed over as being due to a gaseous shadow In order to avoid any errors due to the presence of faecal masses all patients should have a further colonic irrigation some four hours before the barium enema is commenced This X ray should not be omitted even though the cancer has been identified by sigmoidoscopy as a second neoplasm may also exist elsewhere in the



FIG 30
Filling defect due to carcinoma at the junction of the descending and pelvic colons



FIG 31
Small filling defect in an early case of cancer of the pelvic colon



FIG 28
Filling defect in a case of carcinoma of the transverse colon



FIG 29
Obstruction to the flow of barium in a case of carcinoma of the splenic flexure

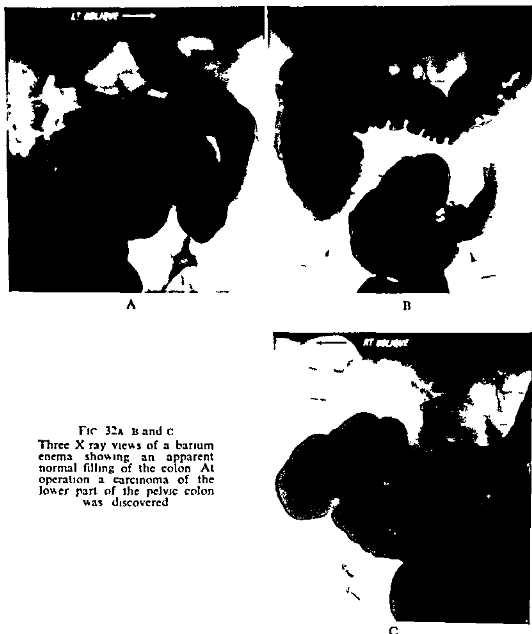


FIG 32A B and C
Three X ray views of a barium enema showing an apparent normal filling of the colon At operation a carcinoma of the lower part of the pelvic colon was discovered

colon and if its presence is recognised before operation the latter may be planned beforehand to include a radical excision of both carcinomata

We know of no cases in which these two investigations have revealed the presence of a neoplasm unsuspected from the history and the clinical examination of the patient, except where sigmoidoscopy has been performed as a routine procedure immediately prior to a haemorrhoidectomy operation By adopting this routine an occasional early and symptomless carcinoma, or an adenoma with pre malignant cellular change has been diagnosed Never theless these investigations help in the differential diagnosis of cases in whom the symptoms could be explained by the presence of a carcinoma and as well as confirming a suspected diagnosis they serve to localise accurately the site of the lesion

CANCER OF THE COLON IN ASSOCIATION WITH NEGATIVE X RAY AND SIGMOIDOSCOPIC FINDINGS

These two investigations may reveal no abnormality in a patient whose story is highly suggestive of carcinoma The neoplasm may be beyond the limit of examination by sigmoidoscopy and at the time of the examination no bleeding may have been seen from above this point to suggest abnormal pathology In addition visualisation of a small growth as a filling defect in a barium enema is not always possible especially if the neoplasm is sited in one of the curves of the pelvic colon where its delineation is obscured by overlying coils of the bowel (Figs 32 and 33) In a series reported by Vynalek Saylor and Schrek (1947) X ray examinations failed to reveal the presence of a cancer when situated in the sigmoid colon in 9 per cent of cases and Wisseman Lemon and Lawrence (1949) including the rectum with the colon estimated that this method of diagnosis was only 79 per cent accurate Minimal symptoms which have brought the observant patient to the doctor are thus often dismissed as being due to haemorrhoids or to some trivial abnormality of the bowel if these aids to diagnosis are reported upon as negative The persistent finding of occult blood in the faeces may help in arriving at a conclusion but if there is any doubt in the clinician s mind the barium enema should be repeated at an early date or alternatively exploratory laparotomy should be advised Few patients will be subjected to an unnecessary operation if the story is that of an early carcinoma and the fatal delay until the disease is well advanced will be avoided The following cases illustrate errors made in the diagnosis due to reliance on X ray findings

Case 4 F N Male aged sixty six Two years prior to his attendance at the Gordon Hospital the patient had noticed the passage of blood which sometimes streaked the stool He noticed increasing constipation relieved by mild purgatives Six months later he reported to his doctor and a barium enema was carried out This showed no abnormality and the patient was reassured that no condition requiring surgery was present The minimal symptoms continued until his attendance at the Gordon Sigmoidoscopy then revealed a growth 15 cm from the anal margin

increased but because of his negative X ray and his past history of dysentery cancer of the colon was not considered When referred to the Gordon Hospital after a further interval of six months sigmoidoscopy revealed a malignant polyp in the pelvic colon and a repeat barium enema a large carcinoma above this Subsequent pathological examination of the specimen removed at operation showed many of the lymph glands to be infiltrated with cancer

The Identification of Cancer Cells in Colonic Smears In an effort to reduce the incidence of error in the definitive diagnosis of cancer of the colon Wisseman and his co-workers have endeavoured to identify cancer cells in smears taken from the wall of the bowel at sigmoidoscopy adapting the method first suggested by Papanicolaou and Traut (1943) With this investigation however the incidence of error is similar to that of a barium enema examination and a negative result does not exclude cancer of the colon from the diagnosis The necessity for exploratory laparotomy in the doubtful case is not avoided and the method of diagnosis therefore would seem to be of little practical value

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Although the patient appeared very well X ray of his chest showed secondary deposits and at operation several deposits were present in the liver

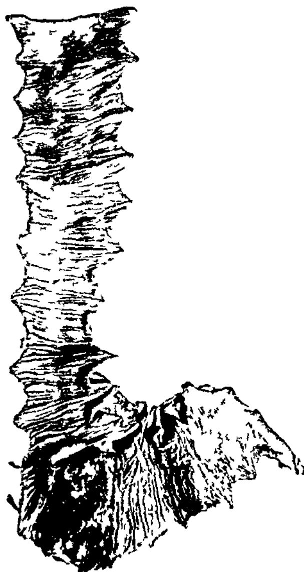


FIG 33
Operation specimen from the patient whose X rays are illustrated in Figure 32

Case 5 G T Male aged forty one Since contracting mild dysentery in the war years the patient had suffered from periodic attacks of diarrhoea and low abdominal discomfort These had increased a year ago when blood was passed and on attending his practitioner a barium enema was advised This showed no abnormality and the patient was treated medically Six months later the same symptoms

THE ANATOMY OF THE LYMPHATIC DRAINAGE OF THE COLON AND ITS RELATION TO THE CHOICE OF OPERATION

The anatomy of the lymphatics has been described fully by Jamieson and Dobson (1909) and by Poirier Cuneo and Delamere (1913) The lymph glands draining any part of the colon are situated along the mesenteric margin of the bowel at intervals along the course of the arteries supplying blood to that region and around the origin of those arteries from the main vascular trunks A maze of lymphatics unites these lymph glands Lymph draining from the colon does not necessarily filter through the nearest glands but may bypass several on its course

This anatomical fact is of great surgical importance as it follows that particles of growth in the lymphatics may not be held up by the lymph glands closest to the carcinoma Moreover in the spread of growth by embolism or permeation from one lymph node to another several glands may likewise be bypassed Thus the most centrally placed lymph nodes may be involved whilst many far closer to the growth may escape invasion

The centrally placed lymph glands drain into those sited around the aorta If these should be involved in the disease their removal by dissection is precluded for anatomical reasons In any case by the time such involvement occurs extension by direct spread and by involvement of the venous supply to the colon will in all likelihood have rendered the case incurable It is possible however in most planned operations to remove all the lymphatics and lymph nodes potentially involved with the disease with the exception of these Their removal entails division of the arteries close to their origin from the main vascular trunks The blood supply of a large area of bowel is thus cut off and it is this affected region of colon that must consequently be removed in any operation designed for the cure of the disease

In many cases it will be obvious at the time of operation that distant lymph nodes are involved Where they are apparently normal minute foci of cancer may already be present only to be revealed by serial sections at the subsequent pathological examination of the specimen Every case must therefore be treated as if the distant glands were infiltrated If the pathological report subsequently shows that no glandular involvement is present this is not a reason to regret that such an extensive operation has been carried out for what is apparently a localised growth but a reason for congratulation It must be remembered that the pathologist can only carry out the examination of a certain number of sections from each lymph node and it is consequently possible that the earliest stage of invasion by growth will pass unrecognised The radical operation is therefore justified whatever the pathological report

THE VASCULAR SUPPLY OF THE LARGE INTESTINE AND ITS RELATION TO RADICAL SURGERY

Consideration of the vascular supply of the various parts of the colon indicates which region of the bowel requires excision in the radical treatment of a lesion of any particular part of the large intestine

CHAPTER IV

THE CHOICE OF OPERATION IN CANCER OF THE COLON

THE SPREAD OF THE DISEASE

As in cancer elsewhere the disease spreads by direct extension in this case through the wall of the bowel and into the tissues in close proximity to the affected region of the colon by invasion of the veins and thence through breaking off emboli to all the body structures particularly the liver and lungs and by lymphatic permeation and emboli to the lymph nodes draining the area in which the growth is sited

Direct spread of the growth in the layers of the bowel is usually not very extensive Black and Waugh (1948) showed that in their series extension by this route did not exceed 12 mm above or below the edge of the palpable margin of the tumour In the occasional case however such as that reported by Cole (1913) or as the following shows to the extreme (Case 6) this method of spread may be far more extensive

Case 6 M D Female aged fifty eight Admitted 28/6/49 with typical history of carcinoma of the pelvic colon confirmed by barium enema X ray At operation the growth seemed confined to the bowel wall but the colon as far as the terminal portion of the transverse colon was thickened A left hemicolectomy was performed Pathological examination subsequently revealed that the thickening was due to extensive submucous infiltration with cancer although the glands were not involved by growth and although extension to the tissues outside the bowel wall had not occurred The patient was alive and well four years after the operation

Nevertheless in the vast majority of patients a comparatively limited excision would suffice to extirpate the region of local spread of the disease

When the growth has extended into the veins cure of the condition however widespread the resection is improbable At this stage emboli are most likely to have been liberated into the blood stream and to have reached the liver by the time of operation Secondary deposits may not be obvious on palpation of the organ at laparotomy but the signs of their presence in the liver are likely early in the post-operative period Limited excisions would thus give results the same as those of the radical operations to be described Fortunately this mode of extension is not common and in the absence of deposits in the liver it must be assumed that it is non-existent at the time of operation

It is however the lymphatic route of spread of the disease that indirectly determines the very extensive resections of the colon that must be undertaken in dealing with cancer affecting these regions

by an anastomosis between the terminal ileum and the proximal half of the transverse colon A similar operation will be required in cases of carcinoma of the ascending colon

This radical operation is of course that carried out by all surgeons in their treatment of cancer of this region It is performed however not always on basic considerations of the radical removal of the area possibly infiltrated

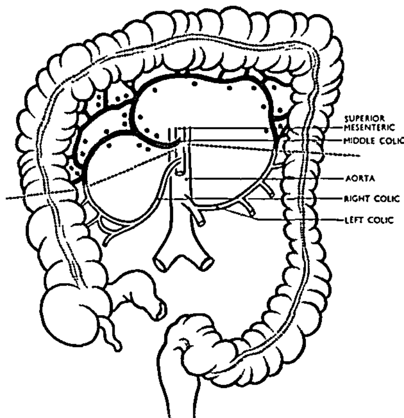


FIG 35
The vascular supply and lymphatic drainage of the transverse colon The essential area of resection in a case of cancer affecting this region is indicated

with malignant disease but because the anastomosis between the ileum and the transverse colon presents a relatively simple operation The area of gut between the anastomotic points is accordingly removed The survival rates of patients suffering from cancer of the caecum are markedly better than in those in whom the cancer has been in the left side of the colon and this is due to the fact that a radical removal is undertaken in the former condition and so often a limited excision in the latter In a series reported by Gilchrist and David (1948) only 37 5 per cent of those patients suffering from carcinoma of the left side of the colon in whom at the time of operation the lymph nodes were involved were alive at the end of five years whereas 77 7 per cent of

1 The Right Side of the Colon The caecum and lower ascending colon are supplied by branches derived from the ileo-colic artery (Fig 34) This arises *from the superior mesenteric artery close to* or by a common origin with the right colic artery the latter supplying the upper part of the ascending colon and the adjacent hepatic flexure The ileo-colic artery by its various branches supplies in addition the terminal few inches of the small intestine

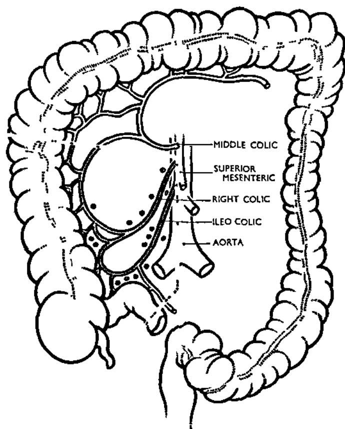


FIG 34
The vascular supply and lymphatic drainage of the right side of the colon The essential area of resection in a case of cancer of the caecum or ascending colon is indicated

In cases of cancer of the caecum therefore the lymphatics potentially involved will surround the ileo-colic artery and lymph nodes which may possibly be the site of metastases will be found at the point of origin of this artery On account of the close proximity of the latter to the right colic artery when this arises by a separate trunk invaded glands are likely to surround its origin as well Radical removal of the region involved with carcinoma will thus entail ligation of the two arteries or their common origin from the superior mesenteric artery Resection of the terminal ileum the caecum the ascending colon and the hepatic flexure is therefore necessary continuity being restored

the left colic artery is given off Ligation of the artery at this site cuts off the blood supply to the whole of the left side of the colon beyond the proximal end of the splenic flexure and also that of the upper part of the rectum A radical operation designed to excise the maximum area of possible lymphatic

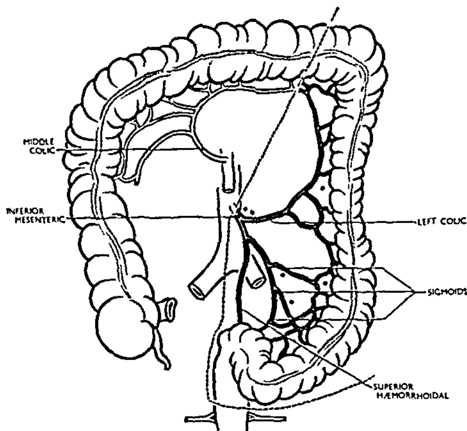


Fig 36
The vascular supply and lymphatic drainage of the left side of the colon and upper rectum The ideal area of resection in a case of cancer of the left side of the colon is indicated

spread secondary to cancer of the descending or pelvic colon requires therefore this wide excision of bowel Continuity is restored by anastomosis of the transverse colon to the middle third of the rectum At this level the rectum is amply supplied with blood by means of the middle haemorrhoidal vessels

Goligher (1954) has drawn attention to the possibility of ligating the inferior mesenteric artery in abdomino perineal excisions of the rectum whilst preserving the descending and upper part of the pelvic colons The artery relied upon to supply these areas with blood is the marginal artery of the colon This artery is a vessel of fair size which runs along the mesenteric margin of

those of a similar category in whom the lesion was in the right side of the colon survived In the opinion of the authors the limited excisions practiced in the former were responsible for the poor results

2 The Hepatic Flexure The hepatic flexure has a dual blood supply partly from the ascending branch of the right colic and partly from the right branch of the middle colic also arising from the superior mesenteric artery (Figs 34 and 35) The lymphatics following both these arteries must be considered as infiltrated with growth and the arteries must therefore be ligated at their origins The bowel deprived of its blood supply includes the terminal ileum the right side of the colon the hepatic flexure the transverse colon and the adjacent part of the splenic flexure This region of gut together with the great omentum must be removed continuity of the bowel being achieved by anastomosis of the ileum to the distal part of the splenic flexure

3 The Transverse Colon In lesions involving the transverse colon the middle colic artery surrounded by the lymph nodes draining the affected area has to be divided close to its origin from the superior mesenteric This necessitates removal of the whole of the transverse colon including the adjacent portions of the two flexures the blood supply of which is partially dependent upon the severed artery (Fig 35) The proximal part of the hepatic flexure is then anastomosed to the distal part of the splenic flexure

4 The Left Side of the Colon Before considering the vascular supply of the splenic flexure and its surgical implications that of the descending and pelvic colons is best described The inferior mesenteric artery arises from the aorta and after a course of an inch or more it gives off the left colic artery This dividing into an ascending and a descending branch supplies the distal portion of the splenic flexure the whole of the descending colon and the immediately adjacent pelvic colon The rest of the pelvic colon is supplied by the sigmoidal arteries which are usually three in number These are the final branches of the inferior mesenteric artery before it continues as the superior haemorrhoidal artery to supply in particular the upper third of the rectum (Fig 36)

In conformity with the pattern of other parts of the bowel the lymphatics and glands draining from the descending and pelvic colons lie in close association with the arteries supplying these regions In the descending colon therefore they surround the left colic artery and in the pelvic colon the sigmoidal vessels From these regions the lymph drains into glands in intimate relation with the inferior mesenteric artery up to its origin from the aorta

In theory therefore if a cancer is present in either the descending or pelvic regions of the colon the most radical operation and that most likely to give the patient the best chance of cure will entail division of the inferior mesenteric artery at its origin from the aorta Only thus is it possible to include in the excision those lymph glands and lymphatics which may well be the site of malignant deposits that surround the trunk of the inferior mesenteric artery between its origin and the point at which its first branch

colic artery have been involved by growth The more limited excision therefore would not have offered the prospects of cure to such patients It is possible that where these glands are involved the disease has already become even more widespread and that no possible resection will extirpate the wide area of its extension But it is equally probable that there are cases in which the disease is still contained in the region excised provided those lymph glands around the first part of the inferior mesenteric artery are included in the excision

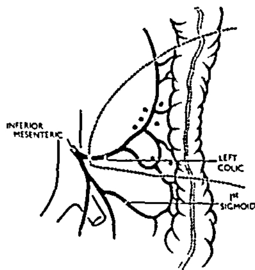


Fig 37
Diagram to illustrate the more limited area of excision carried out in cases of carcinoma of the descending colon in which a left hemicolectomy is considered a too major procedure

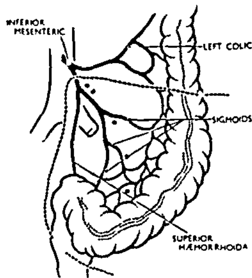


Fig 38
Diagram to illustrate the more limited area of excision carried out in cases of carcinoma of the pelvic colon in which a left hemicolectomy is considered a too major procedure

Ligation of the inferior mesenteric artery at its origin involves an extensive resection of colon and it may be considered that a patient because of his enfeeblement by age or disease may not withstand such a major operation In such cases there is no doubt that the operation of choice will be the less radical one but in the younger and fit patient the wider excision is borne with ease and should therefore be advocated With increasing experience of colonic surgery it is likely that more patients will be deemed to be suitable for inclusion in this second category and in fewer will it be considered that less extensive resection is advisable

At this juncture it can be emphasised that in the wider excision although the left side of the colon is wholly removed sufficient of the large bowel remains to absorb the water content of the faeces adequately The patient therefore does not require to empty his bowel at frequent intervals throughout the twenty four hours and at the most two actions a day when a soft formed stool is passed is all that is required

the colon It links together all of the main arteries which supply the left side of the colon On anatomical grounds it is possible that if the blood supply through the left colic and sigmoidal arteries is interrupted following ligation of the inferior mesenteric artery sufficient blood would flow through the marginal artery, from its union with the left branch of the middle colic to maintain viability of the descending and also of the upper part of the pelvic colon If this viability exists the wide area of lymphatic drainage from a carcinoma of the left side of the colon could be excised without extensive resection of the bowel

It appears that the supply of blood through the marginal artery is sufficient to maintain viability of these regions in about 75 per cent of cases It must be remembered however that Goligher was operating upon cases of carcinoma of the rectum when utilising the marginal artery and no intra peritoneal anastomosis was involved Where such an anastomosis is carried out complete assurance of the blood supply to the ends of the bowel is an essential in every case if disastrous sloughing is to be avoided The blood flow through the marginal artery is uncertain and does not provide this assurance We therefore consider that following division of the inferior mesenteric artery in cases of colonic cancer no attempt should be made to retain any part of the left side of the colon

Less radical excision in cancer of the descending colon which however leaves *in situ* those lymphatics and glands around the trunk of the inferior mesenteric artery entails ligation of the left colic artery at its origin from inferior mesenteric The blood supply of that part of the colon and a part of the splenic flexure only are cut off (Fig 37) The amount of colon requiring removal is therefore limited to these regions and continuity is restored by anastomosis of the distal transverse colon dependent for its blood supply on the middle colic artery to the pelvic colon supplied by the sigmoidal vessels

Similar less extensive excision in cancer of the pelvic colon involves ligation of the inferior mesenteric artery immediately below the origin of its left colic branch so that again the length of bowel deprived of its blood supply is limited and removal of the pelvic colon and upper part of the rectum only is required (Fig 38) Anastomosis of the descending colon supplied by the left colic vessel to the rectum restores continuity

Such excisions although less radical than that suggested above remove a wide area of those regions possibly the site of infiltration with the disease and are of course infinitely to be preferred to a wedge excision which operation commonly practiced particularly in the pelvic colon consists of little more than a local removal of the growth Morgan (1952) advocates them as the standard operations to be performed in cancer involving either the descending or pelvic colons and regards the region excised as sufficiently extensive to extirpate the disease Grinnell and Hiatt (1952) have shown conclusively however and our own observations support their findings that in some cases glands around the inferior mesenteric artery between its origin and the left

THE CHOICE OF OPERATION IN CANCER OF THE PELVI-RECTAL REGION

6 **The Pelvi-Rectal Region** A problem presents in those cases in which the neoplasm is situated in that ill-defined junction between rectum and colon Anatomically the colon runs into the rectum at a level opposite the middle of the third segment of the sacrum but for two inches or so above this level the bowel with a blood supply partly that of the rectum and partly that of the colon and a lymphatic drainage of a similar dual type needs special consideration This region is best referred to as the pelvi-rectal junction or rectosigmoid It lies in close proximity to the upper part of the lateral rectal ligaments and is supplied partly by branches from the lower sigmoid artery and partly from an ascending blood supply from the middle haemorrhoidal vessels Its lymphatic drainage is mainly upwards towards the lymphatics surrounding the inferior mesenteric artery although drainage can also take place *via* those running in association with the middle haemorrhoidal vessels

Lesions occurring in this region have been classed with carcinoma of the rectum and until recently have always been excised by the abdomino-perineal operation of Miles This operation necessitating a permanent colostomy seemed on theoretical grounds unduly extensive and in recent years anterior resections of the type previously described have been carried out in certain clinics Outstanding advocates of this method of resection are Dixon (1944) and Wangensteen (1945) This operation leaves a rectal stump several inches long The section through the rectum could be made at a lower level but if this were carried out the difficulties of completing this already difficult anastomosis between the two cut ends of bowel would be so great that it would be impossible to obtain a satisfactory union A good deal of the lateral ligaments of the rectum and the fibro-fatty tissue on its posterior aspect must thus be left and the danger of local recurrence at the anastomotic site would seem to be a real one

Such early recurrences have been reported by Lloyd Davies (1948) and by Goligher Dukes and Bussey (1951) The latter authors point out that in certain of their cases there was no doubt that the recurrences were due to the fact that the line of section through the rectum had been placed too close to the lower margin of the growth but suggest that in half the cases failure was the result of direct implantation of cancer cells into the cut edges of the bowel at the time of operation That free cancer cells are present mixed with faeces in the lumen of the bowel of patients suffering from cancer of the colon is well known and they are identifiable by the methods described by Wisseman Lemon and Lawrence (1949) Recurrences the result of direct contamination of the abdominal incision with cancer cells liberated from the bowel lumen at the time of operation may also occur as exemplified by the following case

Case M W Female aged sixty-two Admitted in June 1948 with typical history of carcinoma of the colon At operation small secondary deposits were found in the liver and limited excision was carried out for the growth which had

5 **The Splenic Flexure** Reference to Figures 35 and 36 will show that the splenic flexure has a dual blood supply derived from the left branch of the middle colic artery and the ascending branch of the left colic vessel It is thus possible that in a lesion at this site lymphatic spread may involve the lymph nodes around the root of the middle colic artery as well as those sited around the root of the inferior mesenteric artery Theoretical considerations would *therefore suggest that radical removal of the whole region of possible* involvement with the disease would require ligation of both the middle colic and the inferior mesenteric arteries at their origins and thus the excision of the transverse descending and pelvic portions of the colon and the upper third of the rectum Such an operation would necessitate the anastomosis of

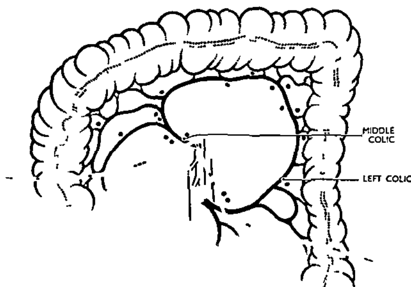


Fig 39
Diagram to illustrate the region excised in a case of cancer of the splenic flexure

the ascending colon to the rectum but in practice it is not possible to mobilise the former sufficiently to enable this to be carried out Practical considerations therefore override theoretical concepts in dealing with cancer of the splenic flexure and in such cases the trunk of the inferior mesenteric artery is left The middle colic artery is divided at its origin from the superior mesenteric artery and the left colic at its junction with the inferior mesenteric vessel A wide area of colon still has to be excised consisting of the transverse colon in its entirety the splenic flexure and the descending colon (Fig 39) A link up is then affected by *suture of the hepatic flexure supplied by the ascending* branch of the right colic artery to the upper part of the pelvic colon the vessel supplying which is the first sigmoidal branch of the inferior mesenteric artery

mosis were carried out through a perineal approach after the bowel had been mobilised through the usual abdominal incision The operation he suggested excised all the structures included in Miles s operation with the exception of the anal canal and ano-rectal junction its supporting tissues and the anterior part of the levatores ani muscle The pathological investigations of Gabriel Dukes and Bussey (1935) and of Coller Kay and MacIntyre (1940) who showed that except in the later stages downward spread of the disease is minimal would support the fact that such an operation is radical in the extent of its removal of tissues possibly infiltrated with carcinoma in cases of recto-sigmoid cancer The operation has more recently been described by the author (1949) and is detailed in Chapter VII

From the above discussion it will be noted that there is variance of opinion in the treatment of lesions at this level However much the surgeon minimises the disability associated with a colostomy there is no doubt that to many patients it is a great trial especially for those who by nature are excessively sensitive or who by virtue of economic circumstances cannot enjoy those toilet facilities that to a colostomy patient are so important Only the close follow up of patients upon whom a sphincter preserving operation has been performed however will finally determine whether its end results when applied to carcinoma of the pelvi rectal junction are the equal of those of Miles s abdomino perineal excision At the present time we employ them only for those patients who decline a colostomy or for those who because of their mental make up or social circumstances would find an artificial anus an intolerable burden

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extended beyond the confines of the bowel wall Three months later a mass appeared in the abdominal scar which on section proved to be a secondary deposit almost certainly the result of implantation at the time of the original resection

Goligher and his co workers record in support of their view that in six of their fifteen cases of recurrence pathological examination of the excised specimen revealed no evidence of lymphatic involvement and in two of these six cases the growth was confined to the wall of the bowel Recurrence by any other means than direct implantation is therefore suggested as being unlikely

It must be accepted that recurrences can occur in the line of anastomosis the result of direct implantation by cells already lying free in the bowel lumen or by fragments of growth separated during the process of mobilisation of the colon at the time of operation and care must be taken to minimise this risk by methods indicated subsequently Nevertheless it is the possibility that such resections in cases of cancer at the pelvi rectal junction may not extirpate the area of the disease that incline many surgeons to perform Miles s abdomino perineal excisions for lesions at this site In a questionnaire circu lated by Rankin and Graham (1950) to fifty surgeons the replies indicated that only eighteen of that number regularly undertook anterior resections for malignant growths in the region of the recto sigmoid The majority like Jones preferred to carry out as extensive and as radical an operation as possible

If Hartmann s (1930) operation is carried out a more extensive excision of the rectum and its surrounding tissue is possible than in an anterior resection with anastomosis as no restoration of continuity of the bowel is attempted In this latter operation the rectum is mobilised in exactly the same way as in Miles s procedure (1908) the lateral ligaments being severed close to the lateral wall of the pelvis and as far down as the pelvic diaphragm The rectum itself is cut across at the same low level the remaining stump being oversewn and left behind as a blind end in communication with the anal canal and anus The upper level of excision lies through the upper part of the pelvic colon which is brought out as a colostomy

The stump of rectum which remains is less than 2 cm in length and as the rectum in a normal adult is some 20 cm long the site at which it is divided is at least 15 cm below the palpable lower margin of a growth in the pelvi rectal region An extensive removal of the bowel especially of the rectum and its lateral ligaments is thus achieved and the theoretical areas of spread of the disease including those in the submucous layer of the rectum should be eradicated As the rectum is cut across so low down however an anastomosis with the upper colon is impossible and the patient does not avoid a colostomy The operation therefore has no advantage compared with that of Miles with the exception that in the very poor risk patient it is of a less major character

In 1935 Pannett suggested that an anastomosis of the upper part of the pelvic colon with the smallest rectal stump could be achieved if that anasto

CHAPTER V

THE PRE-OPERATIVE PREPARATION OF THE PATIENT

THE period of delay occurring between the appearance of the patient s first symptoms and his reference for surgical treatment averages seven months and during this time there is usually a steady deterioration of his condition It is the first purpose of pre-operative treatment to restore this general condition to as near normal as possible and for this and other reasons to be explained it is desirable for the patient to be in hospital for a week to ten days before the operation is undertaken During this time as an up-patient he is given a high caloric and high protein diet containing a low residue Vitamins particularly ascorbic acid a lowered plasma level of which is con ducive to poor wound healing in the post-operative period are administered routinely Hunt (1940) advises doses of 1000 mg of ascorbic acid given daily for three days in order to produce certain saturation with the vitamin followed by a maintenance dose of 100 mg daily until the day of operation

In cases where the blood haemoglobin is below 80 per cent transfusions are given to restore its value to at least this level Not only is a major opera tion less easily borne if the blood haemoglobin is below this figure but post operative thrombosis is more likely to result Administration of iron to correct anaemia is avoided on account of its constipating effect Where pre-operative blood transfusion is not indicated blood grouping is carried out in preparation *for the possibility that it may be required during the operation or in the post* operative phase

Estimations of the plasma proteins are recorded Except in long standing cases of the disease these levels are not reduced but where such reduction exists the high protein diet is supplemented by protein and amino acid con centrates Dehydration is rarely a problem in the early case but replacement by intravenous therapy may be necessary in the patient with more advanced disease

A W R is recorded as rarely a gumma can simulate a carcinoma

Full investigation of the urinary track is not carried out as a routine examination but where associated renal or prostatic disease is present or where urinary symptoms may suggest a spread of the malignant disease to the bladder cystoscopy and intravenous pyelography should be undertaken In other cases it is sufficient to rely on the blood urea which if normal and associated with a normal specimen of urine is indicative of no gross renal pathology

Any dental sepsis must be corrected preferably before the patient comes into hospital but in any case within the first day or two of his admission Operation in the presence of infected tooth sockets is prone to be followed by

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A colonic irrigation room is simple to set up and requires little space The patient undergoing treatment lies in the lateral position on an ordinary examination couch one metre above the foot of which is suspended a large ten litre (approximately two gallon) glass container (Fig 40) A large bore rubber tube one inch in diameter connects this to a glass T tube of similar bore The vertical limb of this is connected by rubber tubing to a waste bucket and the remaining limb to the end of a Jaques No 28 oesophageal tube the end of which is inserted into the rectum (Fig 41) The nurse sits



Fig 41
Photograph to show the introduction of the large bore tube used in colonic irrigation

by the side of the patient and controls the entry and drainage of the fluid into the T tube by simple compression of the rubber tubing (Fig 42) At first the oesophageal tube is inserted into the bowel for about 8 cm only and the lower part of the rectum is cleared by repeatedly irrigating with 75 100 cc of the irrigation fluid When these are returned clear the nurse gently manipulates the tube onwards and the process is repeated at the higher level By degrees each section of the large bowel is cleared and at the end of an irrigation the tube may have been manipulated into the bowel to a distance of over 50 cm The average time taken for such an irrigation is about one hour and as much as fifty litres (forty pints) of fluid will have been used

When the faeces are hardened and partially impacted several sessions may be required to break down their bulk into fragments sufficiently small to allow them to be irrigated away and at the end of the first few sessions the return results may still be dirty However in the majority of cases at the

respiratory track infections in the post-operative period and other preventive methods are of small value if this source of infection is allowed to remain Total extraction is advisable in any doubtful case

A routine X ray of the chest is carried out mainly to exclude the possibility of lung metastases but also in order to eliminate the presence of co existent pulmonary disease

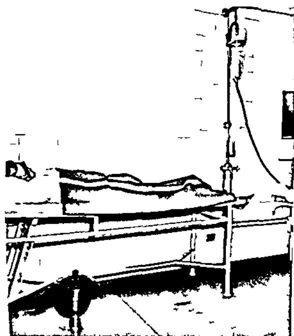


FIG 40
A colonic irrigation room at the Gordon Hospital The receiver in the left hand corner of the photo graph is connected directly with main drainage

This preliminary period is particularly necessary in order that the colon may be cleared of any stagnant faecal content delayed in its normal passage by the presence of the growth An empty bowel is a pre requisite of successful surgery in one stage operations on the colon and its achievement is the most important part of the pre operative regime On the first morning of his stay in hospital the patient is given 8 g (2 drachms) of magnesium sulphate in 150 cc (5 oz) of water This dosage is given on each subsequent morning until forty-eight hours before the operation It is better for the patient to sip this over a period of several hours rather than to take it at once as a milder purgative action results

Each day the patient is also given a colonic irrigation and if faecal impaction is severe this is carried out twice a day There is no doubt that this process is facilitated by the setting up of an irrigation department in any hospital where much colonic surgery is undertaken as with the tube and funnel method carried out in the patient s bed it is far more difficult to clear the colon completely in the great majority of cases

reaction in those patients who are sensitive to them. They are therefore contraindicated in such patients, and inhibition of coliform growth is achieved by giving aureomycin g. 0·25 q.d.s. during the last three pre-operative days.

Finally, the patient is given daily instruction in breathing exercises, preferably by a physiotherapist, so that in the post-operative period he will be efficient in carrying these out. The natural reluctance of any patient who has undergone an abdominal operation to use the diaphragm in this period can be overcome largely by this preliminary instruction, with the result that the incidence of basal collapse of the lungs and superimposed infections are reduced to a minimum.

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end of a course of a week or ten days complete clearance of the bowel will have been achieved

Most patients find these washouts tiring and it is inadvisable to use a volume of fluid in excess of that mentioned Repeated irrigations are far more satisfactory than very prolonged sessions The last washout is given about fifteen hours prior to operation The nature of the fluid used in these irrigations is not important provided that it is non irritant to the bowel We employ a solution of 1 10 000 permanganate of potash



FIG 42
The irrigation in progress

The growth of coliform organisms in the faeces is inhibited by the administration of antibiotics or by chemotherapy or by a combination of the two methods In the past phthalylsulphalthiazole was administered during the last five pre-operative days 9 g being given each day in divided doses Two injections of streptomycin each of 0 5 g were given during the final twenty four hours before operation More recently we have employed guanimycin a preparation of sulphaguanidine and streptomycin sulphate for oral use This mixture is given in 30 cc (1 oz) doses twice daily for the last three pre-operative days each dose containing 2 g of sulpha guanidine and a half a g of streptomycin This method of inhibiting coliform growth appears equally efficacious and from the patient s point of view is a less irksome method of effecting it Streptomycin and penicillin by injection are given on the day of operation

In spite of the low absorbability of the sulphonamide group of drugs the small quantities that are absorbed are quite sufficient to produce an intense

Pentothal (up to 0 3 g) is given and a little cyclopropane used to supplement the nitrous oxide oxygen mixture The main relaxant (e g tubarine 2 mg per stone body weight) is given when the towels are in position and is often sufficient to last throughout the operation During the operation it is wise to repeat the gastric suction at frequent intervals and to perform a careful tracheo bronchial toilet at the end The patient should not be returned to the ward unless an active cough reflex is present If for some reason the cough reflex is absent or feeble the cuffed tube should be left *in situ* until the patient is coughing briskly

From time to time the anaesthetist is presented with a patient who having been obstructed for days is little short of moribund In these cases premedication should be reduced to a minimum (e g Morphia gr 1/6 and Atropine gr 1/100) and Pentothal induction avoided altogether After gastric suction it is possible to induce these patients with cyclopropane and oxygen and with the assistance of 50 mg of Scoline to intubate them with a large cuffed tube A small further dose of relaxant (e g 10 mg of Tubarine) is often sufficient when combined with nitrous oxide cyclopropane and oxygen to complete the operation

Anaesthesia for the obstructed patient is very like flying—the dangers are at the take-off (induction) and the landing (recovery) With proper precautions the maintenance is relatively safe

The surgery of colonic obstruction frequently occurs in three stages

1 Laparatomy and colostomy which occurs when the patient is obstructed and which is performed as an emergency operation

2 Resection of the colon which is the major procedure but by this time the patient is not obstructed and the blood chemistry has returned to normal limits

3 Closure of the colostomy which is a relatively minor operation but requires adequate abdominal relaxation

ANAESTHESIA IN ULCERATIVE COLITIS

Great care is called for in anaesthetising patients with ulcerative colitis Prolonged medical treatment has failed to control the disease and surgical intervention is often called for in a patient who is emaciated dehydrated toxic and very anaemic The minimum amount of anaesthetic *e g* 0 4 g of Pentothal 10 mg of Tubarine with cyclopropane and oxygen is almost invariably adequate The three essentials in the surgery and anaesthesia of ulcerative colitis are —

1 Quick surgery
2 Minimum anaesthetic
3 Prompt and adequate resuscitation

The really ill patient will not survive the operation unless these three conditions are observed

CHAPTER VI

ANAESTHESIA

C B Lewis

THE fundamental anaesthetic problems of major colonic and rectal surgery are those of general abdominal surgery However, there are many important points of anaesthetic technique and management which belong particularly to this field and which it is proposed to consider

From the anaesthetist s point of view the main factor of note in colonic *surgery is whether or not the patient is obstructed If not* most operations on the colon may be regarded as ordinary laparotomies and a simple Pentothal nitrous oxide oxygen relaxant sequence given The nature of the relaxant should depend on the proposed duration of the operation and the anaesthetist s own particular preference Again it is advisable but not essential to intubate the patient To avoid overdosage with Pentothal light cyclopropane inhalation anaesthesia or intravenous pethidine may be used

ANAESTHESIA IN THE OBSTRUCTED CASES

The obstructed patient is always a potential anaesthetic hazard due to the possibility of vomiting Small gut obstruction causes earlier and far more frequent vomiting but here it is an obvious danger and steps are usually taken to deal with the situation In large gut obstruction the first intimation the anaesthetist receives of the patient s full stomach may be an overwhelming vomit during the induction this is one of the commonest causes of anaesthetic morbidity and mortality

Every obstructed patient should have the stomach emptied pre operatively through a Ryle s tube It is unlikely that the stomach will contain solid or semi solid material but if this is suspected a large size stomach tube should be used and the stomach washed out Just prior to induction a final aspiration of the stomach is performed

A quick induction is essential and is best achieved with minimum Pentothal *e g* 0 4 g for the average patient and Scoline 50 100 mg The *lungs are inflated with oxygen for about thirty seconds following* which a large (size 8 10) cuffed endotracheal tube is passed under direct vision and the cuff inflated immediately

During these manoeuvres it is wise to have an efficient sucker at hand or if this is not available a series of swabs on holders in case the unexpected vomit appears *The Scoline apnoea will last for some minutes during* which time the lungs are inflated When automatic breathing is resumed more

or Pethidine may be given depending on the individual patient The main relaxant (e g Tubarine 2 2 5 mg per stone body weight) is given when the patient is in position Adequate ventilation is maintained with nitrous oxide and oxygen supplemented if necessary by a little cyclopropane With the patient in the Trendelenburg position it is most important to keep the lungs properly inflated Further Tubarine (10 15 mg) may be given about one hour after the initial dose but it is surprising how seldom a second dose is necessary It is essential to keep the Pentothal dosage to a minimum and to give an adequate dose of relaxant

It is helpful if the anaesthetist remembers to see that every patient is catheterised before the operation starts

The Miles Abdomino perineal Excision There are one or two small points of anaesthetic technique which arise in connection with this operation During the abdominal part the less Trendelenburg tilt maintained the better for the patient It is as well for the anaesthetist to check that the shoulder rests are properly adjusted and that the table breaks opposite the knees The position of the arm is always a problem in these operations A 45 degrees abduction of the arm on the assistant s side has proved a satisfactory solution When the Trendelenburg position is adopted the assistant stands above this arm and it does not get in his way When later the patient is restored to the flat position this should be done by instalments otherwise a severe fall in blood pressure may occur

The abdominal part of this operation is not usually a shock producing procedure However if this stage turns out to be prolonged and difficult a blood transfusion should be set up and the second stage delayed until the patient's condition has improved A reasonable delay between stages makes the patient so much better able to stand the perineal stage Turning the patient on to the side should be done as gently as possible In the average case where the abdominal stage has passed off without difficulty the blood transfusion should be set up before the patient is turned in anticipation of the inevitable blood loss during the perineal stage of the excision It is usually most convenient to set up this transfusion into the uppermost arm as soon as the patient is turned on the side and it is also advisable to see that the other arm with the patient lying on it does not become congested

If at the end of the operation the blood loss from the perineum has been more than usual and the patient is shocked he should remain in the theatre until his condition has improved When it is considered safe he should be transferred from the operating table to his bed thus avoiding further man handling in the ward

The Synchronous Combined Excision From the anaesthetic point of view this operation has the advantage of taking less time than the Miles operation However it has the disadvantage of causing much more shock to the patient over a short time That being so a blood transfusion should be

ANAESTHESIA FOR ABDOMINO PERINEAL SURGERY

From the anaesthetist s point of view all the problems of major rectal surgery are encountered in the abdomino perineal resection Until fairly recently the traditional anaesthetic advocated for this operation (Miles or synchronous) was a high spinal This anaesthetic provides the advantages to the surgeon of total relaxation and minimal bleeding

Its main disadvantages are —

1 Severe fall in blood pressure

2 Post-operative headache Mild headaches appearing in the first two or three post operative days and lasting for a further two or three days are extremely common Though often controllable by posture and simple analgesics these headaches are incapacitating to a patient for whom early ambulation is essential The severe intractable headache is fortunately rare and the numerous methods of treatment which have been suggested are a reflection on the efficacy of any one of them

3 Retention of urine would appear to be commoner after spinal anaes thesia than after general anaesthesia

4 Cauda equina lesions occur from time to time Fortunately they usually clear up spontaneously Permanent cauda equina lesions are perhaps not as rare as is imagined Most experienced neurologists can quote cases of greater or lesser degree

As relaxation is no longer difficult to achieve the spinal should not be regarded as the anaesthetic of choice for abdomino perineal resection However we believe it still to be indicated for the obese patient in whom it is anticipated that the surgical approach will be difficult A minimum dose of Pentothal should be administered so that the patient is asleep before the spinal is given A light general anaesthetic (Pentothal nitrous oxide oxygen and cyclopropane) should be maintained throughout the operation It is essential to intubate all abdomino perineal cases whether they have received a spinal anaesthetic or not as adequate oxygenation is essential and often difficult to achieve with the patient in the Trendelenburg position with the face relatively inaccessible to the anaesthetist

It is not proposed to go into the details of the various spinal techniques available All appear to give good results when properly administered We adopt the Etherington Wilson technique using 12 14 cc of hypobaric nupercaine Whichever technique is used it is essential to maintain the strictest aseptic precautions Intramuscular ephedrine gr 1 may be given to maintain the blood pressure Very rarely it may be necessary to use an adrenaline drip (2 cc of 1 in 1 000 adrenalin to 500 cc saline) Noradrenalin (Levophed) 4 mg per litre produces a more sustained effect

For the average patient the anaesthetic of choice is again a Pentothal Scoline nitrous oxide oxygen and cyclopropane Tubarine sequence 50 100 mg of Scoline is given to enable intubation to be carried out orally with a large (size 8 10) cuffed endotracheal tube Further small doses of Pentothal

CHAPTER VII

OPERATIVE TECHNIQUE IN THE NON-OBSTRUCTED CASE

GENERAL CONSIDERATIONS

The Inadequacy of Exteriorising Operations

At the completion of any of the radical operations suggested in Chapter IV the bowel lacks the mobility that is possessed before the resection but the line of suture is under no tension whatsoever Yet it is quite impossible in any of the resections carried out for lesions of the transverse colon or of the left side of the colon to lift the suture line out on



Fig 43

Photograph showing a colostomy which following a Paul Mikulicz operation has failed to close The resection in this operation has been inadequate and recurrences in the bowel ends and the adjacent skin and subdermal structures are shown

to the surface of the anterior abdominal wall This fact alone shows that excisions carried out in any exteriorising operations of the Paul Mikulicz type or by means of the Rankin obstructive resection are not sufficiently

set up before this operation starts and as it proceeds any blood loss (mainly again from the perineum) made good

During the operation owing to the position of the patient it is not possible to have an arm abducted However as a transfusion is set up before the operation starts the arms can remain at the side without embarrassment to the anaesthetist as the necessary drugs may be injected into the tubing of the transfusion apparatus

Anaesthesia for major colonic and rectal surgery involves no very special techniques but it does demand implicit care and constant appreciation of the patient s condition

Is a Preliminary Colostomy Necessary?

Before proceeding to the detailed description of the resections with immediate end-to-end anastomosis which we consider best in the treatment of cancer of the colon certain debatable aspects of the operations must be noted The question arises as to whether a defunctioning colostomy should be instituted behind the line of bowel suture either at the time of the main operation or some days prior to its performance or whether it may with safety be avoided altogether The aesthetic disadvantages of a colostomy are very great when of necessity it has to be sited towards the right side of the colon where the faecal content is only semi fluid and tends to discharge at frequent intervals on to the surface of the abdomen Of greater importance however are the disadvantages of its presence from a surgical point of view Firstly the line of suture of the bowel ends at the site of the resection is deprived of the gentle dilative effect of the passage of soft faeces when the bowel commences to act Thus post-operative stenosis is more likely to occur Secondly the closure of a colostomy is associated with a definite though low mortality Thirdly the occasional case occurs in which partial breakdown of the line of closure of the colostomy necessitates further operation for its repair Fourthly an incisional hernia may develop at the site of closure Fifthly adhesions forming around the region of closure may give rise to intestinal obstructions later in the patient s life Finally if the colostomy can with safety be dispensed with the patient will be spared the hazards of more than one operation and the disadvantage of a prolonged stay in hospital

Before the advent of modern methods of bowel sterilisation few surgeons advocated anastomosis following excision without a preliminary colostomy or caecostomy The danger of intraperitoneal leakage— The result more often of infection at the suture line than of failure of the blood supply' (Rankin 1941)—was a very real one Thus proximal decompression was favoured amongst others by Wilkie (1934) Whipple (1931) Dixon (1939) and Cheever (1931) The introduction however of chemotherapy has inclined an increasing number of surgeons to carry out large bowel resections with immediate anastomosis and without any associated diversion of the faecal flow Amongst the advocates of this method are Stone and McLanahan (1942) Meyer Sheridan and Kozoll (1945) and Waugh and Custer (1945) Such writers however as Maes and Essring (1949) and Butler (1952) still advocate a preliminary decompression operation

Our own opinion is that a preliminary colostomy or caecostomy is unnecessary when operating upon a patient who is unobstructed and who has undergone the pre-operative preparation indicated in a previous chapter Even if slight leakage from the line of anastomosis should occur the almost sterile nature of the intestinal content renders this a complication of very slight importance and in our few cases where this has occurred healing has taken place in a very short period of time Rowe Spaulding Madajewski and

radical because in all such cases the limbs of gut through which continuity is to be established reach to the surface of the abdominal wall They are performed at the expense of leaving behind areas of meso-colon potentially the site of disease and recurrences will inevitably be more frequent Figure 43 shows the abdominal wall in the region of the double barrelled colostomy which following a Paul Mikulicz operation had not entirely closed The massive recurrences in the bowel ends and in the skin and subcutaneous tissues are shown Further resection of the affected ends of the bowel and of the infiltrated tissues was undertaken and at the second procedure end to-end anastomosis was readily performed thus proving the inadequacy of the initial resection

For those still dubious about the value of a Paul Mikulicz type of operation in the treatment of non-obstructed cases of carcinoma of the colon let it be said that apart from the inadequacy of the excision it is accompanied by far more discomfort to the patient than the one stage resections to be described Only in some cases of pelvi rectal carcinoma should a colostomy complicate these latter operations In all other regions they are carried out in one stage with restoration of continuity at the time of the resection Patients are therefore spared the anxieties of a colostomy which because of its initial fluid discharge is always more unsatisfactory in the first weeks of its constitution Moreover following a Paul Mikulicz operation the colostomy does not always close when the spur intervening between the two ends of the bowel has been crushed and a further operation may be required before continuity of the ends of the colon is established Finally post-operative complications of local or general peritonitis and of obstructions around the emerging loops of the colostomy are not absent in this procedure post operative incisional herniation in the region of the exteriorised gut is also not uncommon

Provided that the bowel has been adequately prepared and that modern aids of chemotherapy have been employed in the preliminary pre operative stage of the treatment we consider that the Paul Mikulicz operation and its modifications have no place in the modern treatment of carcinoma of the colon Moreover even before the days of bowel sterilisation the operative mortality associated with the latter operation was higher than that occurring in patients in whom an end to-end anastomosis had been carried out by an aseptic technique The average mortality of series reported by MacFee (1937) Wilkie (1934) Stone and McLanahan (1939) and Gibbon and Hodge (1945) was 14 per cent for patients upon whom an end to-end anastomosis had been carried out and 27 per cent amongst those subjected to an exteriorising type of operation

Regarding wedge excisions enough has been said to suggest that they too should never be employed in an operation the aim of which is the cure of the patient

represented a great advance in technique but with modern pre-operative treatment we consider that such methods of anastomosis are unnecessary and that a more certain union of the cut ends of the bowel can be achieved by open anastomosis Moreover in anastomoses deep down in the pelvis application of the clamps necessary for carrying out an aseptic anastomosis is impossible when the extensive resections subsequently to be discussed are undertaken We therefore employ an open anastomosis in all cases

OPERATIVE PRINCIPLES

Immediate Pre-operative Catheterisation of the Patient

As soon as the patient is anaesthetised and arranged on the operating table he or she must be catheterised The discovery of a partially-distended bladder after the abdomen has been opened may so obscure the operating field that anastomoses are rendered difficult where otherwise they would be easy The decision to pass a catheter in such circumstances requires disturbance of the patient and the dressings and thereby endangers the sterility of the wound In all colonic surgery no matter where the lesion may be sited catheterisation must be carried out as a routine before the abdomen is opened When the assistant withdraws the catheter after all the urine has been drained away he must press with his free hand firmly over the suprapubic region Failure to do this in an anaesthetised person will result in air being sucked through the catheter and thus into the bladder and its distension with air will prove as embarrassing to the surgeon as though it were filled with urine

The Abdominal Incision

In cases of neoplasm on the right side of the colon a right paramedian incision is best and for those on the left side a left one The incision should be generous enough to allow for full exposure and mobilisation of all parts of the colon likely to come within the sphere of operation The oblique muscle-slitting incisions do not give as good an exposure as the paramedian and they do not offer the same facility of approach if an unsuspected second carcinoma should be found in the colon at operation We therefore reserve this incision for those patients who are old and feeble and also in whom the carcinoma is so far advanced that a cure is unlikely The muscle-cutting incisions in such cases have the undoubted advantage of speed of exposure and closure

The Necessity of a Full Abdominal Exploration

The first stage of the operation after the peritoneum has been opened is a thorough examination of the abdominal contents The liver is first examined for the possible presence of palpable metastases as their existence will alter the scope of the resection of the colon The whole of the lower

Bacon (1948) showed that when sulphathalidine was administered for three and a half days prior to operation in doses of 0 1 g per kg body weight the faecal coliform count was diminished by 99 99 per cent It is this factor of bowel sterilisation which is now possible associated with the initial colonic irrigations and the operative detail of the anastomosis that makes immediate anastomosis without associated decompression the method of choice and safety when dealing with all cancers of the colon above the level of the recto sigmoid

When dealing with carcinoma of the recto sigmoid region by the method of reconstructive abdomino perineal excision we consider that a transverse colostomy should be carried out before the operation In such a procedure partial breakdown of the line of suture is more likely because the blood supply to the pelvic colon—which has been brought down into the perineum—is not so copious as that supplying the bowel ends in other resections Therefore there is a better chance to achieve primary union by eliminating faecal flow over the suture line until healing is complete

Open or Aseptic Anastomosis?

The next point of debate is whether the anastomosis should be by the open or by the so-called aseptic method The latter was originally introduced by Parker and Kerr (1923) as a means of establishing continuity of two ends of bowel without exposing their lumina to the general peritoneal cavity Soiling of the peritoneum with faeces escaping from the cut ends of the colon was thus avoided

H H Kerr (1923) describes the procedure as follows —

Division of the intestinal walls is made between two narrow crushing clamps placed first in actual contact and then slightly separated so that there is left between them a narrow crushed area consisting practically of serosa and fibrous coat which may be divided by knife or cautery

The basting stitch is a Cushing s continuous stitch without knots placed upon the clamped incision with loops between the stitches crossing over the blades of the clamp When the clamp is removed and the stitch at the same time drawn tight the edges of the incision are automatically inverted and held firmly pressed together in a straight line without any separation of the lips of the opening having occurred The two incisions so prepared are then placed side by side and are stitched together around the whole circumference of the intestinal tube or of the new operative opening that is to be established When the last suture has been tied the basting stitches are withdrawn the intestinal canal or the new anastomotic stroma then instantly becomes patent

Modifications of this method are also described by Fraser and Dott (1924) Rankin (1928) and Brenizer (1934) all of whom are advocates of this type of anastomosis It must be remembered however that the aseptic method was introduced prior to the days of bowel chemotherapy when if peritoneal contamination occurred the risks of infection were very real It

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In the Trendelenburg position the small intestines fall into the upper quadrant of the abdominal cavity They are readily maintained in that position after insertion of the self retaining retractor by suitable packing with abdominal packs Then all that lies exposed in the field of operation are those parts of the bowel with which the surgeon has to deal

The subsequent procedure of the operation will vary in accordance with the site of the growth but before proceeding further something must be said concerning the suture material used in colonic anastomoses

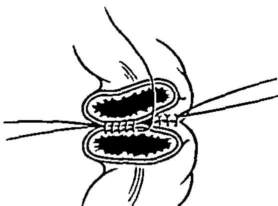


Fig 45

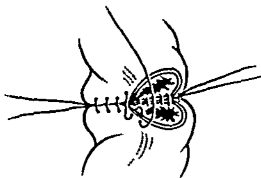


Fig 46

Fig 45 and Fig 46

Diagrams to illustrate the method of approximation of the bowel ends used in all cases of resection of the colon Fig 45 shows the initial layer of interrupted thread sutures and the commencement of the catgut suture approximating the mucosal edges Fig 46 illustrates the continuation of this latter suture using the Connel inversion stitch

The Suture of the Bowel Ends

Two layered anastomoses have been carried out in all our operations the site of the anastomosis being reinforced by a few interrupted sutures The superficial lines of sutures approximate the sero-muscular coats of the bowel or where no peritoneal covering exists as in anastomoses to the rectum or ano-rectal region sero-muscular to fibro muscular coat (Fig 45) Interrupted stitches of No 80 thread are used for these layers and we regard much of the freedom from leaking at the site of the anastomosis to the fact that this material has been employed With thread a closer and firmer approximation of the two layers of bowel wall can be achieved than with catgut and there is no danger of any knot slipping Moreover there is no chance of the ligature becoming absorbed before union of the gut is complete The mucosal edges are approximated by a continuous suture of No 0 catgut this suture traversing all layers of the adjacent edges of the bowel wall When it is continued from the posterior to the anterior layer of the anastomosis a Connel inversion stitch is invariably used (Fig 46)

In this stitch the needle traverses all layers of the wall of the gut passing from the outside into its lumen The needle is then passed in the reverse

bowel is then searched to exclude a second carcinoma in addition to that localised in the preliminary investigation of the patient Even though a barium enema has been carried out a second small neoplasm may have escaped visualisation as has been pointed out in Chapter III

The Trendelenburg Position

When the carcinoma is situated below the splenic flexure the patient is tipped *into the Trendelenburg position the table being angled to about 40* degrees (Fig 44) In maintaining the patient in this position there are two

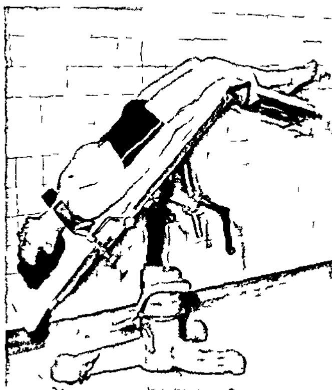


Fig 44
The Trendelenburg position used in operations involving anastomoses deep in the pelvic cavity

points that need special attention *firstly the shoulder rests must be well* padded so that there is no danger of any pressure on the cervical plexus of *nerves with resultant nerve palsies secondly* care must be taken to prevent any pressure on the popliteal fossa by the angle formed in the table when it has been broken behind the patient s knees Any pressure maintained for nearly two hours in this region may well give rise to post operative thrombosis in the popliteal vein with all the complications associated with it This danger will be eliminated *if the two parts of the table are covered with separate pieces* of heavy sorbo rubber

abdominal wall It is necessary to clamp the meso-colon before division as backflow oozing and bleeding from small arteries in the posterior abdominal wall will otherwise obscure the site of the dissection When the division has reached the level of the hepatic flexure the transverse colon is pulled up into

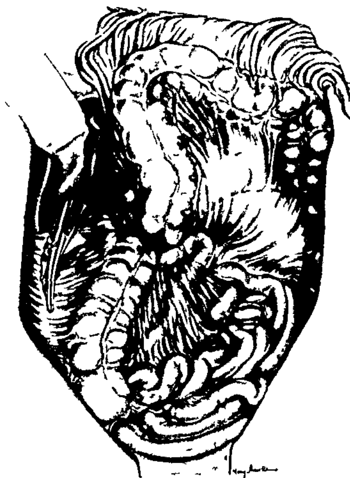


FIG 47

Right hemicolectomy The right half of the colon is being mobilised by incision of the peritoneum in the paracolic gutter The hepatic flexure has been separated from the duodenum with which it is in close contact

the wound and the middle colic artery is identified in its meso-colon This main artery is carefully preserved from injury whilst the right third of the meso-colon is cut across close to its origin from the posterior abdominal wall The medial part of this incision is then carried forwards at right angles towards the transverse colon reaching this at the point at which resection is to be carried out During this stage of the dissection small branches of the middle colic artery will be cut across after being picked up with artery forceps

direction from the lumen to the outside emerging 2 mm from the point at which it was first inserted When the catgut is pulled tight the mucosal edges are completely inverted so that any difficulty in burying this edge during the final layer of interrupted thread sutures is avoided completely Moreover *the stitch is absolutely haemostatic*

OPERATIVE DETAIL

Radical Excision of Carcinoma of the Caecum or Ascending Colon

The peritoneum is incised along the right paracolic gutter from below the lower border of the caecum as far up as the upper limit of the hepatic flexure suitable retraction by an assistant facilitating the latter part of this preliminary dissection (Fig 47) At this point is seen the reflection of the edge of the great omentum on to the junction of the lateral and posterior walls of the abdomen Although *involvement of the omentum is likely only* by direct extension from the primary neoplasm or by infiltration from glandular deposits it is advisable to remove that part associated with the proximal transverse colon which is also to be included in the excision The right third of the omentum therefore is divided between artery forceps just below the stomach and above the transverse colon It is best to start this division towards the midline and as it is carried out laterally it will meet the incision of the peritoneum in the paracolic gutter at its highest point

A suitable area in the transverse colon—usually about 10 cm *from* the hepatic flexure—is then selected as the proposed site of section and anastomosis Below this the great omentum is divided vertically

The right side of the colon the caecum and the proximal 10 cm of the small intestine are then mobilised inwards This mobilisation is best carried out by gauze dissection *using specially prepared 2 cm long swabs* which are held in long artery forceps and by occasional snips with the scissors The procedure is practically free from bleeding The ureter is often drawn forwards and inwards as it lies loosely attached to the mesentery of the colon now being mobilised and if this should occur it must be stripped gently backward toward the psoas muscle The spermatic or ovarian vessels may likewise require freeing

High up in the dissection the hepatic flexure lies in front and in close proximity to the second part of the duodenum from which it is separated by loose areolar tissue Careful separation of these two structures is required at this point When this flexure has been freed towards the midline the mobilised gut is held up into the wound and the ileo-colic and right colic arteries supplying the region to be resected can be readily recognised These and the accompanying veins *are freed close to their origins from the superior* mesenteric vessels and they are clamped and divided The ends are then ligated

The ascending meso-colon and the distal few centimetres of the mesentery are divided between artery forceps close to their reflection from the posterior

passing through all three layers of the adjacent edges of large and small intestine completes the posterior layer of the anastomosis This is continued to the anterior layer the mucosal edges being inverted by employing the Connel type stitch Just before the anterior layer is finally closed the clamps

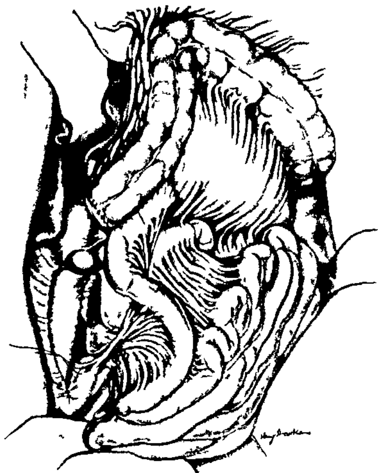


FIG 48
Right hemicolectomy The right side of the colon has been removed and continuity established by iso peristaltic anastomosis of the ileum and the transverse colon

applied to the bowel must be released in order to ensure that no bleeding is coming from the line of anastomosis Should a bleeding point be identified this must be under run and controlled by a small mattress suture The sero muscular layer of ileum and transverse colon are then drawn over this anterior layer again by interrupted thread stitches The anastomosis is further sealed by stitching over it any portion of the omentum that is suitably placed

The raw area in the posterior abdominal wall is then recovered with peritoneum This is easily effected by stripping the peritoneum from the

The appendices epiploicae and the great omentum are then dissected away from the bowel in the region of the proposed line of section When the colon is subsequently cut across a small cuff which is unobscured by fatty tissue will thus have been made available and an accurate closure of the open end can then be achieved

The terminal mesentery which has previously been separated from the posterior abdominal wall is then divided outwards to reach the mesenteric margin of the terminal ileum some 10 cm from the ileo caecal valve The region of the bowel which is deprived of its blood supply is then ready for removal This dissection will have been performed with a negligible loss of blood

Crushing clamps are applied to the ileum distal to the proposed site of section and to the colon proximal to the point of subsequent division Light non-crushing clamps are used on the bowel which is to be retained Abdominal packs are then arranged so as to protect the peritoneal cavity from any contamination The gut is removed by cutting it across with scissors or knife but not with diathermy If diathermy were used the considerable heat generated might cause delayed necrosis of the cut edge so that leakage from the line of anastomosis might occur in the post-operative period

Although the ileum may safely be cut across at right angles the colon should be divided obliquely so that slightly more of its anti mesenteric part than of its mesenteric portion is removed This important detail of colonic resection was emphasised by Lockhart Mummery (1917) He pointed out that owing to the distribution of the small vessels in the wall of the colon the vascular supply of the anti mesenteric portion of the bowel was likely to be deficient if a section at right angles were carried out

Continuity between the ileum and the transverse colon may be established by either a side to side iso peristaltic union (Fig 48) or an end of ileum to side of transverse colon anastomosis We usually employ the former The open ends of the ileum and transverse colon therefore are closed the former by a continuous through and through catgut suture which is either sub sequently invaginated into the ileum by a purse string suture or embedded by a sero muscular one The closure of the end of the transverse colon is best achieved by a continuous inversion Connel stitch the suture line being reinforced with interrupted sero muscular stitches of No 80 linen thread Both ends are then further sealed off by suturing over them any adjacent small tags of omentum meso-colon or mesentery The non-crushing clamps are then removed

The next procedure is the anastomosis between the terminal ileum and transverse colon The two portions of bowel are approximated to each other for about an inch by a series of interrupted sero muscular sutures of No 80 linen thread Non-crushing clamps are then applied to prevent spilling of intestinal content into the wound when the bowel is opened The approxi mated transverse colon and ileum are then incised A continuous gut suture

between forceps placed close to its origin from the posterior abdominal wall At its lateral ends the incision is carried forwards to the flexures The transverse colon and its appendages are now ready for removal and after clamps have been applied to the bowel it is divided through the flexure on either side

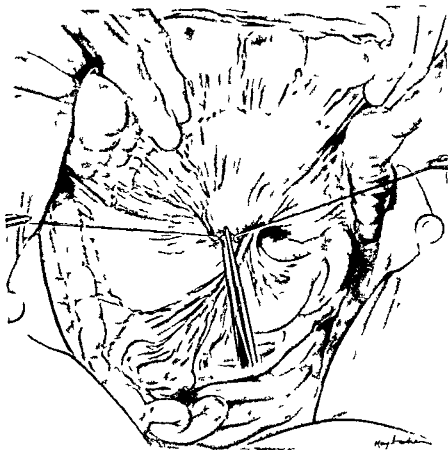


FIG 50
Excision of the transverse colon The middle colic artery is ligated and divided close to its origin from the superior mesenteric artery

The cut ends of the colon are drawn towards one another It may be found that the preliminary mobilisation of the ascending and descending colons has been insufficient to permit them to be approximated without tension In such a case further mobilisation must be carried out by stripping the colon more extensively from its loose attachment to the posterior abdominal wall The surgeon need never feel worried that he may be unable to achieve approximation as this is always possible

The first layer of the anastomosis is a sero muscular one with interrupted thread sutures It is far simpler in any end to-end anastomosis to insert all

muscles of the lateral abdominal wall and suturing it to the medial free edge of peritoneum which is left after the removal of the ascending colon A certain amount of ooze is likely from this area and it is wise to drain it The tube may be brought out either through the main incision or through a stab wound in the flank The abdominal wound is then closed

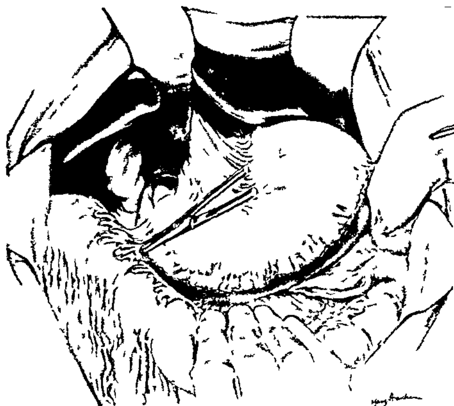


FIG 49
Excision of the transverse colon The omentum between the upper margin of the transverse colon and the stomach is being divided

Radical Excision of Carcinoma of the Transverse Colon

Radical treatment of this condition requires removal of the whole of the transverse colon its meso-colon and the attached omentum After suitable isolation of the operation site with abdominal packs the lesser sac of peritoneum is opened by dividing the omentum just above the upper margin of the colon (Fig 49) The division is carried laterally to the right and to the left as far as the flexures where the incision is carried downward The upper portion of the peritoneum of the paracolic gutters is thus incised allowing the ascending and descending colons to be mobilised The supporting peritoneal ligaments of the flexures are also divided

The transverse colon is then held upwards into the wound and the middle colic artery is identified close to its origin It is isolated divided with artery forceps and ligated (Fig 50) The base of the meso-colon is then divided

The medial peritoneal reflection from the colon on to the posterior abdominal wall is also incised This incision extends from the rectum to a point about 5 cm above the division of the aorta at which level the inferior mesenteric artery branches from this structure The colon is drawn inwards towards



FIG 52
Excision of the transverse colon Continuity has been established following mobilisation by anastomosis of the hepatic to the splenic flexure

the midline by blunt dissection of its exposed meso-colon and by separation of retaining fibro fatty bands with cuts of the scissors As the mobilisation extends upwards to involve the splenic flexure the condensation of the peritoneum which forms the phrenico-colic ligament will require division As soon as this has been cut through the flexure can be drawn inwards into the wound

At this juncture the ureters on both sides must be identified and separated from the lateral reflections of peritoneum The ureters are then followed and partially dissected away from their supporting tissues well down into the pelvis Sometimes the ureter on the left side is adherent to the fibro fatty structures of the mobilised meso-colon and in such cases it must be separated therefrom with gentle dissection in order to avoid any damage to its blood

these sutures placed at intervals of about 2 mm before they are tied (Fig 51) In order to avoid any tangling of the threads the ends of each stitch are grasped in an artery forcep and one of the handle rings of this is passed over the end of a similar pair of longer forceps When all the stitches have been inserted the assistant pushes the gut ends together and supports them in this position handing to the surgeon one by one the artery forceps in which the thread ends are secured These are then tied As the handle of each forcep has been *slipped over the end of a large forcep in* the order in which the stitches were inserted there can be no confusion in the order in which they are presented to the surgeon for tying It is best to cut each stitch as it is tied except the first and last of the row which secured in artery forceps will serve to identify the limits of the layer when the next line of stitches is being inserted

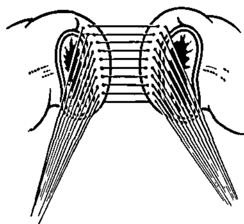


FIG 51
Diagram to illustrate the insertion of all sero muscular sutures before they are tied

A continuous gut suture passing through all coats of the two edges of the bowel completes the posterior line of anastomosis and is carried forward on to the anterior layer Inversion of the mucosa is achieved by the Connel stitch The sero muscular layers are approximated over this line of sutures again by interrupted linen thread stitches and the anastomotic lines are covered further by suturing over them any adjacent appendices epiploicae (Fig 52) Raw areas left by the excision and by the mobilisation of the ascending and descending colons can be partially covered with peritoneum stripped from the lateral abdominal wall The wound is closed with drainage to these areas

Radical Excision of the Hepatic Flexure

The possibility that lymph glands may be involved around the origins of both middle colic and right colic arteries necessitates extensive resection in growths of this region Radical removal therefore can only be achieved by combining the two resections described above (Fig 53) An anastomosis between the small intestine and the more distal part of the splenic flexure carried out in a fashion identical to that discussed in the anastomosis between the ileum and transverse colon will then restore the continuity of the bowel (*Fig* 54)

Radical Excision of Carcinoma of the Descending or Pelvic Colon

The desirability of carrying out a hemicolectomy in all such cases if the *widest possible excision* of the lymphatic area of drainage is to be attempted has been explained in a previous chapter The peritoneum of the lateral para colic gutter is incised from the upper rectum to the splenic flexure (Fig 55)

male where the peritoneal reflection lies at a higher level than in the female the recto vesical septum is incised and the rectum is separated from the bladder as far as the upper part of the prostate This dissection combined with the division of the upper third of the lateral ligaments in both sexes mobilises the rectum so that its lower part can be drawn up into the pelvis The final anastomosis to the lower rectal end is thereby rendered easier

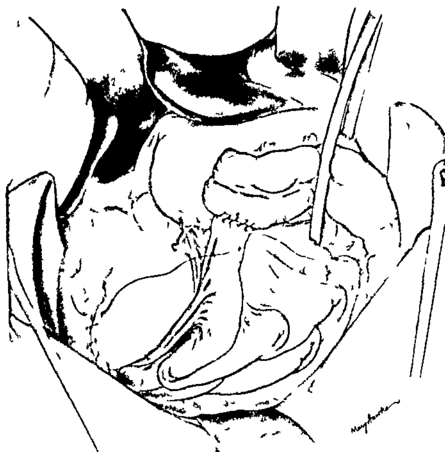


FIG 54

Radical excision in a case of carcinoma of the hepatic flexure The areas mobilised as shown in the previous figure have been excised and continuity re established by anastomosis of the terminal ileum to the splenic flexure

The rectum is then mobilised from its posterior attachments The pelvic meso-colon is incised at its reflection on to the posterior abdominal wall opposite the upper sacral segment thus enabling the hand to be passed down into the pelvis between the sacrum and the rectum thereby separating the loose fibro fatty tissue which alone connects the two structures Mobilisation of the rectum to the extent required by the dissection is then complete

The colon is then held over towards the midline and the origin of the inferior mesenteric artery is identified at the root of the meso-colon It is

supply The spermatic or ovarian vessels may be similarly adherent and require dissection away from the meso-colon

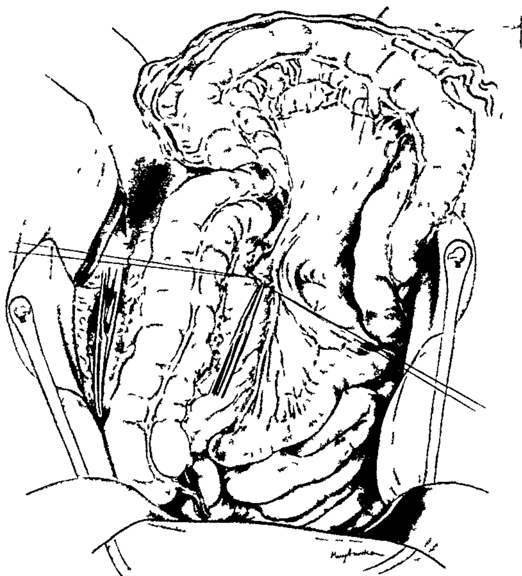


FIG 53
Radical excision in a case of carcinoma of the hepatic flexure The ascending colon the hepatic flexure and the transverse colon are being mobilised prior to excision The middle colic artery has been isolated at its origin and following double ligation is being picked up with artery forceps

The two peritoneal incisions on either side of the rectum are now joined by incising the peritoneum at its line of reflection on to the uterus or bladder according to the sex of the patient (Fig 56) From these structures the peri toneum is stripped so that an edge is available for subsequent suture In the

male where the peritoneal reflection lies at a higher level than in the female the recto-vesical septum is incised and the rectum is separated from the bladder as far as the upper part of the prostate This dissection combined with the division of the upper third of the lateral ligaments in both sexes mobilises the rectum so that its lower part can be drawn up into the pelvis The final anastomosis to the lower rectal end is thereby rendered easier

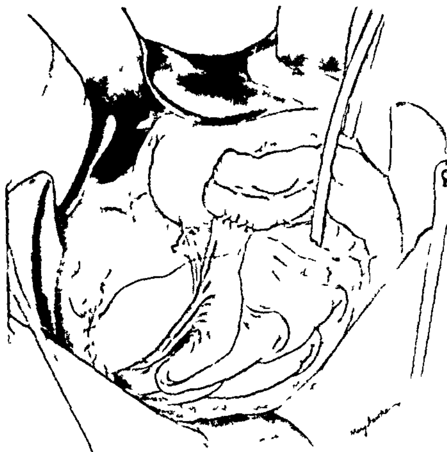


FIG 54
Radical excision in a case of carcinoma of the hepatic flexure The areas *mobilised* as shown in the previous figure have been excised and continuity re-established by anastomosis of the terminal ileum to the splenic flexure

The rectum is then mobilised from its posterior attachments The pelvic meso-colon is incised at its reflection on to the posterior abdominal wall opposite the upper sacral segment thus enabling the hand to be passed down into the pelvis between the sacrum and the rectum thereby separating the loose fibro-fatty tissue which alone connects the two structures Mobilisation of the rectum to the extent required by the dissection is then complete

The colon is then held over towards the midline and the origin of the inferior mesenteric artery is identified at the root of the meso-colon It is

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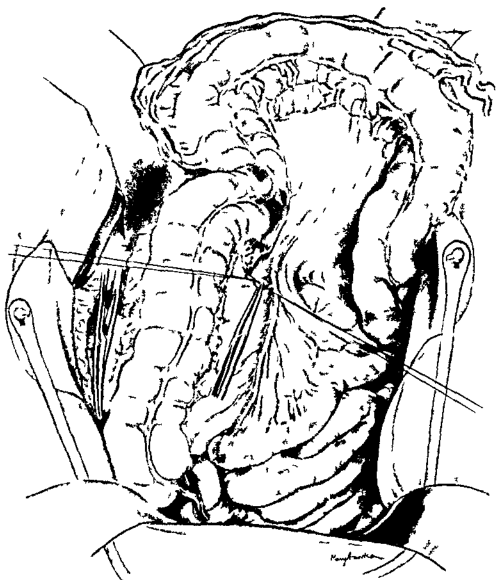


FIG 53

Radical excision in a case of carcinoma of the hepatic flexure The ascending colon the hepatic flexure and the transverse colon are being mobilised prior to excision The middle colic artery has been isolated at its origin and following double ligation is being picked up with artery forceps

The two peritoneal incisions on either side of the rectum are now joined by incising the peritoneum at its line of reflection on to the uterus or bladder according to the sex of the patient (Fig 56) From these structures the peri toneum is stripped so that an edge is available for subsequent suture In the

laterally the line of incision will meet the divided peritoneum of the lateral paracolic gutter at the splenic flexure With the separation of the omental attachment to the stomach the transverse colon becomes more mobile and it can then be estimated with what ease its distal end will stretch down into

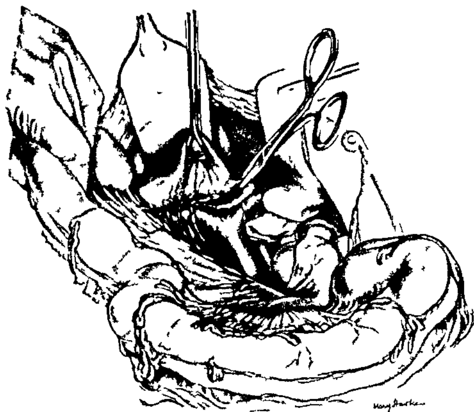


FIG 56

Radical excision for carcinoma of the descending or pelvic colon The incision of the peritoneum at the side of the rectum is continued downwards and the reflection on to the bladder is divided

the pelvis for the subsequent anastomosis Should any difficulty be apparent further mobilisation of this portion of the colon may be achieved by dividing the upper leaf of the peritoneum of the transverse meso-colon and the many underlying fibro fatty bands which support and tether the transverse colon to the posterior abdominal wall The ease with which the colon may be brought down into the pelvis to the rectum is then apparent

That portion of the distal end of the transverse colon which is to serve for the anastomosis is then selected and its arterial supply is identified This

divided between artery forceps and ligated The whole of the posterior attachment of the mobilised meso-colon of the pelvic and descending portions of the large bowel is then cut across close to the reflection on to the posterior abdominal wall The incision is made between artery forceps to prevent the backflow of blood from the severed veins which would otherwise leak into



FIG 55
Radical excision for carcinoma of the descending or pelvic colon Commencing mobilisation of the whole of the left side of the colon

the wound and obscure the field of operation Separation is continued as far as the splenic flexure so that the whole length of colon between it and the mid rectal region lies free from any attachment except its continuity with the bowel above and below

Separation of the left half of the great omentum from its attachment to the stomach is then carried out the lesser sac of peritoneum being thereby opened As the division of this structure between artery forceps proceeds

middle third there is insufficient room to apply a non-crushing clamp below the site of proposed section A clamp is therefore applied to the rectum above this line and supporting its lower part with two Babcock s intestinal forceps placed one on either side the rectum is cut across with scissors thus completing the excision of the left side of the colon (Fig 58)

The rectal stump is then held open with the Babcock s forceps and is swabbed out with gauze swabs soaked in a solution of 1 500 perchloride of mercury The end of the transverse colon is similarly treated so that no faecal particles are present to contaminate the line of anastomosis which is now to be made (Fig 59)



Fig 58
Photograph of a specimen removed by left hemicolectomy The growth is situated at the junction of the descending and pelvic portions of the colon

It will be appreciated from the above description that the end of the transverse colon is to be anastomosed to a rectal stump that is devoid of peritoneal covering Where such a layer is absent we are particularly con vinced of the value of using interrupted thread and not catgut sutures on the initial line of the anastomosis In this operation more than in any of the other resections the advantages of inserting the whole line of sutures before they are tied will soon be appreciated by the surgeon who is working deep in the pelvis Each stitch in the first layer which will approximate fibro

is derived from subsidiary branches of the left branch of the middle colic artery and care must be taken to avoid any injury to the main vessel The meso-colon opposite the point of selection is incised back to the posterior

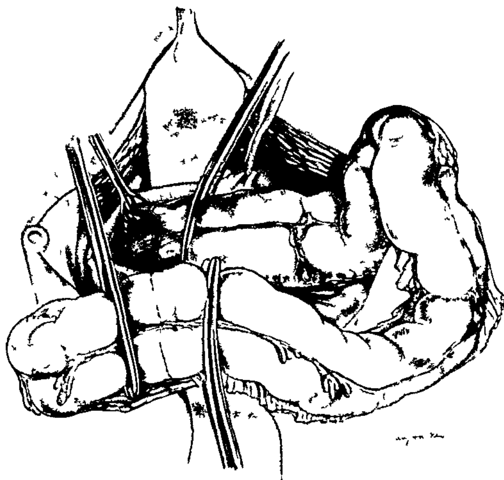


FIG 57
Radical excision for carcinoma of the descending or pelvic colon The whole of the left side of the colon the terminal portion of the transverse colon and the upper part of the rectum have been mobilised The lines of section through the upper third of the rectum and the distal third of the transverse colon are indicated

wall and the incision is then continued outwards to join that which has severed the meso-colon of the left side of the bowel

The great omentum is divided vertically opposite the point in the trans verse colon selected for section The dissection is now completed Suitable clamps are applied to the distal end of the transverse colon and it is then divided (Fig 57) Because of the low site of division of the rectum through its

the longitudinal fibres of the outer muscle coat of this organ Inserting the stitches in this way will produce a slight puckering of the edge of the rectum when the stitches are finally tied In all cases the cut end of the colon is smaller than that of the rectum and this is therefore no disadvantage Once this initial line of anastomosis has been established no difficulty will be experienced in completing the further layers the suturing of which is carried out in a manner identical to that previously described In view of the fact that the rectum has no peritoneal covering and because there is no adjacent tissue with which the suture line can be reinforced it is wise to add a third layer of interrupted sutures to the standard two which are now completed This last line again approximates the fibro-muscular coat of the rectum to the sero muscular coat of the colon In this final line of anastomosis the sutures are placed much more widely apart five or six being as many as are required When continuity of the bowel has been completed the transverse colon will pass over the brim of the pelvis Although it cannot be lifted forward to any extent it lies comfortably and under no tension

The edge of the peritoneum covering the bladder or uterus according to the sex of the patient which was freed at an earlier stage in the operation is now sutured to the transverse colon just above the site of the anastomosis

It is impossible to reperitonealise wholly the lateral paracolic gutter by stripping up the peritoneum of the lateral abdominal wall and suturing it to the transverse colon as this part of the bowel now occupies a position well medial to that which the left side of the colon previously filled In its lower part above the anastomosis the peritoneum is sutured to the bowel But above this level no attempt is made to cover the remaining raw area No ill effect seems to result from leaving this and if for any cause the abdomen is re-opened some months later a natural reperitonealisation of the area will be found to have occurred

It is however essential to suture the free edge of the transverse meso colon to the medial free edge of the peritoneum of the posterior abdominal wall in order to prevent the small intestine pushing behind the large bowel and becoming obstructed Before it was appreciated that the transverse colon must be sutured accurately to the posterior abdominal wall two of our cases became obstructed in the post-operative period and operation revealed that both were due to this cause The subsequent recovery of these patients was then uninterrupted

A drainage tube is then passed down into the pelvis through the recon stituted peritoneum its length being such that the end reaches down to the side of the line of anastomosis The wound is then closed the drainage tube being brought out through its lower end This tube should not emerge through a separate stab incision in the left iliac fossa Should leakage occur from the suture line the discharge will not drain well through this longer track and spreading infection is likely to result In our few cases in which there has been slight faecal discharge the fistula has caused no constitutional disturb ance and has always closed quickly when the drainage tube has been brought

muscular coat of rectum to sero muscular coat of transverse colon is difficult *to insert with accuracy into the former structure and it is still more* difficult if the field of vision is partially obscured by the transverse colon that has been brought down when the first suture has been tied If the stitches are all inserted before they are tied the minimum difficulty will be experienced in completing this difficult layer of the anastomosis

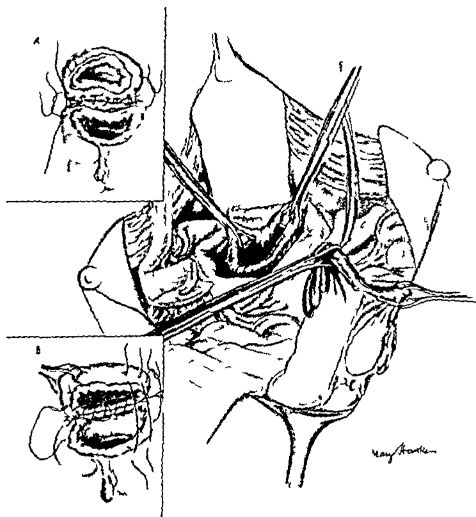


Fig 59
Radical excision for carcinoma of the descending or pelvic colon The end of the transverse colon is being approximated to the open end of the middle third of the rectum The insets illustrate the anastomosis of the two ends

Although the rectum at the level of the anastomosis is devoid of peritoneal covering there is little tendency for the stitches to cut out provided that a good bite of the rectal wall is taken up with each stitch In addition it is best to insert these stitches parallel not at right angles to the open end of the rectal stump By so doing there is less likelihood of their tearing through

the longitudinal fibres of the outer muscle coat of this organ Inserting the stitches in this way will produce a slight puckering of the edge of the rectum when the stitches are finally tied In all cases the cut end of the colon is smaller than that of the rectum and this is therefore no disadvantage Once this initial line of anastomosis has been established no difficulty will be experienced in completing the further layers the suturing of which is carried out in a manner identical to that previously described In view of the fact that the rectum has no peritoneal covering and because there is no adjacent tissue with which the suture line can be reinforced it is wise to add a third layer of interrupted sutures to the standard two which are now completed This last line again approximates the fibro muscular coat of the rectum to the sero-muscular coat of the colon In this final line of anastomosis the sutures are placed much more widely apart five or six being as many as are required When continuity of the bowel has been completed the transverse colon will pass over the brim of the pelvis Although it cannot be lifted forward to any extent it lies comfortably and under no tension

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out in the suprapubic position In one case in which the tube was brought out through a separate stab wound however the inefficient drainage resulted in the formation of a pelvic abscess which required subsequent incision

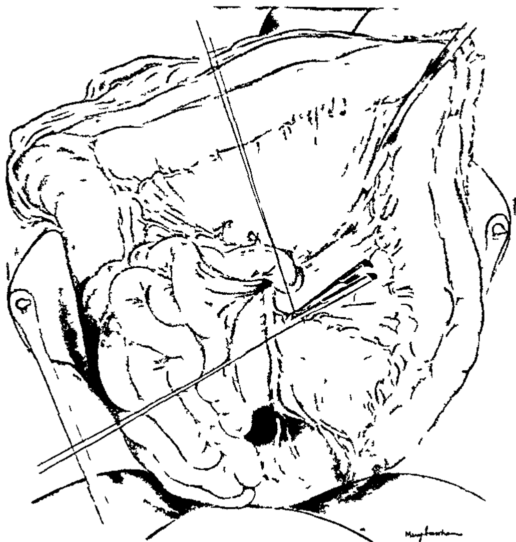


FIG 60
Radical excision for carcinoma of the splenic flexure The illustration shows the division of the middle colic and the left colic arteries close to their origins The area of colon supplied by these arteries and the accompanying meso-colon is then excised

Radical Excision of Carcinoma of the Splenic Flexure

In considering the lymphatic anatomy of the colon the close association of the lymphatics and their glands with the arterial supply has been noted In the operation previously described for radical excision of cancer involving the descending or pelvic portions of the colon we emphasised the desirability

of ligating the arteries close to their origin from the main arterial trunks if the widest possible zone of potential spread of the disease is to be removed

In cancer involving the splenic flexure it is necessary to modify the extent of the radical excision required by the principles laid down This is on account

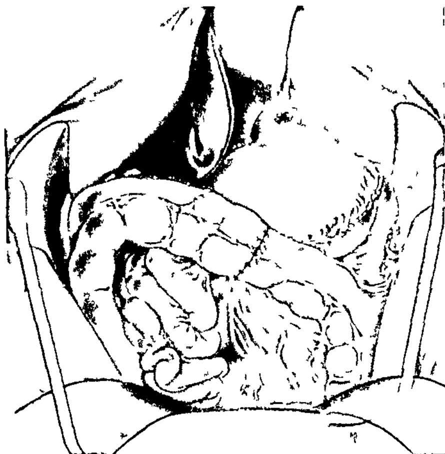


Fig 61

Radical excision for carcinoma of the splenic flexure Restoration of continuity has been established by anastomosis of the hepatic flexure to the upper end of the pelvic colon

of the very extensive excision that would result from adhering to these concepts and the impracticability of establishing continuity of the colon at the end of such a procedure The blood supply to the splenic flexure is as has been explained (*see* Chapter 4) a dual one It is derived partly from the middle colic artery and partly from the inferior mesenteric artery The ligation of both of these vessels at their origins would deprive the distal portion of the hepatic flexure the whole of the transverse descending and pelvic portions of the colon and the upper part of the rectum of their blood supply It would therefore necessitate their removal Apart from the extent of such an excision it would be difficult to mobilise the proximal part of the hepatic flexure to allow

it to be brought down to the rectal stump for subsequent anastomosis The operation would have to consist of a total colectomy with anastomosis of the small intestine to *the rectum—a procedure which in such cases is* outside the bounds of practicability

The excision therefore is modified and the radical excision carried out involves ligation of the middle colic artery at its origin and the left colic vessel at the point where it is given off from the inferior mesenteric artery (Fig 60) That portion of the bowel deprived of its blood supply consists then of the transverse and descending colons and continuity can be established by anastomosis of the distal end of the hepatic flexure to the pelvic colon (Fig 61) The detail of the operation therefore is a combination of that described under Radical excision for carcinoma of the transverse colon and that which follows under the heading Modified radical excision for carcinoma of the descending colon

A less radical removal of growths in this region involves ligation of the left branch of the middle colic artery and the left colic vessel so that the distal part only of the transverse colon is removed with the descending colon continuity being established by anastomosis of the free end of the transverse colon to the upper end of the pelvic colon However it would seem that especially in the growths which mainly involve the proximal portion of the flexure the wider excision offers a better chance of permanent cure to the patient Also the technique of the operation presents no difficulties It should be carried out on all patients except those who have more distant secondary deposits or those unlikely to stand anything more than a limited operation because of their general condition

Modified Radical Excision for Carcinoma of the Descending Colon

As in the procedures previously described the small intestines are packed away from the field of operation The peritoneum is then incised along the left paracolic gutter from the level of the upper third of the pelvic colon up to the splenic flexure The peritoneal folds supporting this angle in the colon are cut through and the descending colon and the flexure are mobilised inwards This separation from the posterior abdominal wall is aided by using small swabs of the type described any fibrous bands which anchor the colon being cut through with scissors The ureter and spermatic vessels must then be identified and if adherent to the mobilised mesentery they are separated so that they lie away from the bowel on the posterior abdominal wall

The omentum is then divided above the distal half of the transverse colon thus opening the lesser sac of peritoneum Where it joins the peritoneum of the lateral abdominal wall the incision will unite with that made in the left paracolic gutter By dividing the omentum above the distal half of the transverse colon increased mobility is given to the latter structure so that its subsequent approximation to the pelvic colon is facilitated

The left side of the colon is lifted up into the wound and the left colic artery dissected clear of the fibro fatty tissue in the mesentery close to its

origin from the inferior mesenteric artery It is divided between forceps and ligatured The mesentery of the descending colon is then cut across between artery forceps close to its peritoneal reflection on to the posterior abdominal wall At its upper limit the incision is continued through the left extremity of the transverse meso-colon and then forward to the mesenteric margin of the corresponding portion of the transverse colon Below the incision in the descending meso-colon is carried outwards through the upper part of the pelvic meso-colon to the margin of the pelvic colon The colon between these two points is then excised after suitable clamps have been applied to the bowel and after the peritoneal cavity has been protected with abdominal packs

In most cases the cut end of the transverse colon can be brought down to that of the pelvic colon with great ease If it appears that the subsequent anastomosis is likely to be under any tension whatsoever further incision of the omentum between the stomach and transverse colon will usually give the added mobilisation required Further lengthening of the transverse colon can also be achieved by incising the peritoneum of the upper layer of its meso-colon followed by division of some of the many fibrous bands that form its framework Careful section of these will allow the end of the transverse colon to be brought down a further few centimetres

The anastomosis between the two ends of the colon is proceeded with in a way identical to that previously described A drainage tube is passed down to the site of the anastomosis and the wound is closed

Modified Radical Excision for Carcinoma of the Pelvic Colon

After the usual isolation of the field of operation the peritoneum is incised along the left side of the root of the pelvic meso-colon The incision is carried downwards into the pelvis at the side of the intraperitoneal portion of the rectum where according to the sex of the patient the peritoneum is reflected on to the bladder or uterus The incision is continued inwards to divide this peritoneal reflection The peritoneum on the right side of the meso-colon is similarly divided and passing down the right side of the upper part of the rectum the incision meets the divided peritoneal reflection on to the bladder or uterus In the male patient the rectum is then further separated from the bladder for about 2 cm partly by blunt dissection with small swabs and partly with scissor dissection As has been explained in Chapter IV the upper part of the rectum which is deprived of its blood supply has to be removed in this operation This separation will allow the lower part of the rectum to be drawn up so that the subsequent anastomosis will be facilitated The peritoneum is then stripped from the pelvic walls so that both ureters are fully identified and the upper thirds of the lateral rectal ligaments can then be divided without fear of injury to these structures A few bleeding points from small branches of the middle haemorrhoidal vessels may be encountered but these are readily controllable with diathermy

The lower pelvic colon and rectum are loosely attached to the sacrum by fibro fatty tissue and this attachment is separated by blunt dissection together with a few snips of the scissors It is then necessary to expose the inferior mesenteric artery at the base of the upper part of the pelvic meso

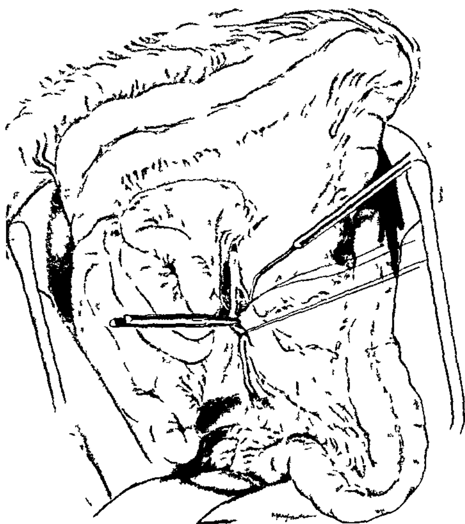


FIG 62

The modified radical excision in a case of carcinoma of the pelvic colon The inferior mesenteric artery has been identified just below the point of origin of its left colic branch and it is being ligated at this level The pelvic colon and the upper part of the rectum are deprived of their blood supply and are resected

colon At this level the left colic artery has already been given off and its origin may not be seen But its descending branch and the sigmoidal arteries will be identified readily The main artery is cut between artery forceps above the origin of the first sigmoidal artery The meso-colon is then cut outwards towards the bowel the incision reaching this at the level of the lower part of the descending colon The pelvic colon and the upper rectum are now

all but completely freed from their attachments a few bands of fibro fatty tissue alone requiring division at the upper part of the pelvic meso-colon

Before removal of this part of the bowel the descending colon should be more fully mobilised so that the lower end may be brought down to the rectum without difficulty The peritoneal reflection along the paracolic gutter is therefore incised upwards in some cases is far as the splenic flexure The colon is then separated from its posterior attachments and brought towards the mid line any fibrous bands in the meso-colon that bind it down being divided Extensive dissection is rarely required and there is no difficulty in obtaining adequate mobilisation

The region of bowel deprived of its blood supply is then excised (Fig 62) It is possible to apply intestinal clamps at the upper level of this excision a soft clamp to the descending colon and a crushing clamp to the pelvic colon But at its lower end although a curved crushing clamp may be applied to the bowel just proximal to the line of the proposed section a clamp on the rectal stump is impracticable for the reasons previously described Before the rectum is cut across it is best to steady it by means of Babcock s intestinal forceps placed on either side of the bowel below the proposed line of section These clamps will also prevent retraction of the rectal stump when the division is completed Following resection of the bowel any faecal material is cleared from its exposed ends with moist swabs Anastomosis between the cut end of the descending colon and the rectal stump is then completed by adopting the technique described in considering the operation of left hemicolectomy

Raw areas are reperitonealised the free edge of the peritoneum over the lower part of the bladder or uterus according to the sex of the patient being sutured to the descending colon just above the line of anastomosis A split drainage tube is passed down to the side of the anatomosis through the peritoneum of the floor of the pelvis and the wound is closed

Radical Excision of Carcinoma of the Junction of the Pelvic Colon and Descending Colon

In such cases left hemicolectomy must be undertaken as the lymphatics draining this region will follow the upper sigmoidal artery as well as the descending branch of the left colic artery *Any alternative to this procedure* is in the nature of a local wedge excision only and except in the very old and feeble it must be avoided

Radical Excision of Carcinoma of the Pelvi Rectal Junction

As has been explained previously opinion varies with regard to the essen tial area of excision necessary in such cases and only many years of careful follow up can provide the final answer The operation of anterior resection is identical to that described in the section on modified radical excision for *carcinoma of the pelvic colon The alternative method of reconstructive* abdomino perineal excision described by Pannett (1935) and the abdominal perineal excision of Miles (1908) will therefore be detailed

RECONSTRUCTIVE ABDOMINO-PERINEAL EXCISION OF THE PELVIC COLON AND RECTUM

In view of the possibility of implantation of carcinoma cells into the raw edges of the cut end of the rectum as suggested by Goligher Dukes and Bussey (1951) especial precautions must be taken in an operation that aims at sphincter preservation Before the abdomen is opened therefore the patient is sigmoidoscoped by an assistant and the bowel below the growth is swabbed with pledglets of cotton wool soaked in a solution of 1 500 per chloride of mercury Before removing the scope a similar pledglet is packed into the bowel just below the growth so that any fragments broken off during the operation will be held up by this plug of cotton wool This plug will be contained in that part of the bowel which is to be excised so that the rectum below this level should be free from any contamination by growth As an added precaution the rectal stump is swabbed out with moist gauze swabs soaked in the same solution before the anastomosis is commenced

The initial stages of the operation are essentially those of the abdomino perineal operation The peritoneum on either side of the colon and the rectum is incised The lower ends of these incisions are united by dividing the peri toneum at its line of reflection on to the bladder or on to the uterus according to the sex of the patient (Fig 63) The bowel is separated posteriorly from its attachments to the sacrum and anteriorly from the posterior wall of the bladder and the prostate in the male and from the upper part of the vaginal vault in the female It is essential that this anterior separation shall be exten sive and carried down to the level of the pelvic diaphragm After identification of the ureters the lateral ligaments of the rectum are divided for the whole of their extent the operation having so far proceeded along classic lines

The incision in the peritoneum along the outer side of the pelvic colon is then continued upwards towards the splenic flexure and the descending colon is mobilised inwards It is then necessary to examine the vascular supply to the upper part of the pelvic colon which is to be brought down into the perineum for subsequent anastomosis The vascular pattern in this area varies from individual to individual but close to the mesenteric margin of the bowel a vascular arcade connecting the sigmoidal vessels is usually present The upper part of this arcade communicates with the descending branch of the left colic artery The inferior mesenteric artery is identified and is divided below the point at which its first sigmoidal branch is given off The meso colon is cut across below and parallel to the latter artery as far as the arterial arcade The incision in the meso-colon is then continued downwards on the mesenteric side of this arcade for about seven cm

It will now be apparent that the main structure preventing further elonga tion of the upper part of the pelvic colon is the first sigmoidal artery which tethering the bowel to the inferior mesenteric artery prevents its natural curve from straightening out Reliance on the blood supply to this part of the colon must be placed on this artery and not on the descending branch of the left

colic artery which as noted also supplies the arterial arcade The first sigmoid artery must therefore be carefully preserved Nevertheless some increase in its length may be achieved by incision of the fibro-fatty bands that support it in the meso-colon This freeing of the artery must be continued up to its origin from the inferior mesenteric vessel Division of similar bands in the

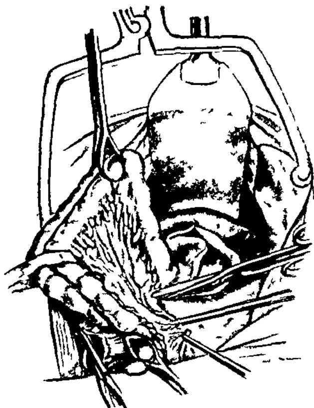


FIG 63

Reconstructive abdomino perineal excision for a tumour in the pelvi rectal region The peritoneal reflections from the pelvic meso colon and from the lateral aspects of the rectum are being divided Anteriorly the peritoneal reflection from the rectum on to the bladder has been incised The inferior mesenteric artery is divided below the origin of its first sigmoidal branch

pelvic meso-colon and the lower part of the descending meso-colon will likewise produce further elongation of the bowel by straightening out any puckerings that normally exist

The length of the first sigmoidal artery varies Where it is short sufficient straightening of the upper part of the pelvic colon to allow it to reach the perineum cannot be achieved The surgeon therefore has to decide at this stage whether a sphincter preserving operation is feasible If the colon at the

level of the lowermost point in the divided meso-colon can be pushed down as far as the pelvic diaphragm with ease anastomosis with the ano rectal junction will be possible If it is obvious that this part of the colon will not reach the pelvic floor or that the gut when reaching it is under any tension whatsoever the attempt at sphincter preservation must be abandoned and a full abdomino perineal excision must be proceeded with



FIG 64
The mobilised pelvic colon has been pushed into the pelvic cavity The peritoneal floor of the pelvis is being reconstructed and sutured to the wall of the upper part of the pelvic colon

It is then essential to make absolutely certain that the blood supply to the colon at the proposed point of anastomosis opposite the divided meso-colon is assured The arterial arcade at this level is therefore cut across before picking it up with artery forceps and free bleeding will indicate an adequate blood supply If bleeding does not take place the surgeon must

consider a point higher up in the colon for the site of his subsequent anastomosis If such a point is too high to allow the pelvic colon to be brought down to the pelvic floor freely an abdomino-perineal excision of the Miles s type is required

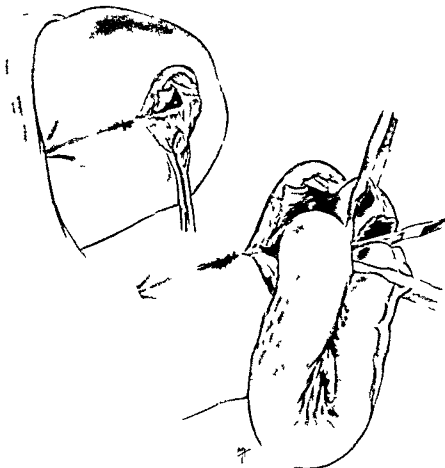


FIG 65

Reconstructive abdomino-perineal excision, the perineal stage of the operation In the upper diagram the skin flap has been dissected downwards and the coccyx with the attached levatores ani muscle has been removed. In the lower diagram the bowel has been drawn out of the wound and trans-section of the pelvic colon is being carried out The pubo-rectalis muscle is seen surrounding the ano-rectal region

If it is possible to continue with the sphincter preserving operation the freed colon is then pushed down into the cavity of the pelvis and the peritoneum of the pelvic floor is re formed and sutured around the emerging colon as high up as is feasible (Fig 64) A transverse colostomy is now formed and the abdomen is closed

The patient is turned on to his right side A curved skin incision is made extending from just behind the anal orifice to the lower part of the sacrum and the flap is reflected The coccyx is then separated from the sacrum through the sacro coccygeal joint and severed from its attachments A finger can now be passed into the wound above the posterior halves of the levatores ani muscles which are then cut through The attachment of the fascia propria



FIG 66
Reconstructive abdomino perineal excision The anastomosis of *the pelvic colon to the rectal stump following excision of the bowel*

of the rectum to the lower sacral segment is incised and the pelvic colon and the rectum are then drawn out through the perineal wound (Fig 65) At the junction between the anal canal and the rectum to the left of the wound the pubo rectalis portion of the levatores ani muscle is easily identified running as a sling around the wall of the bowel and merging intimately with the internal sphincter A clamp is applied to the bowel about five cm above this and the rectum is then cut through about a cm above the sphincter The lowest part of the colon the blood supply of which has been shown to be adequate during the abdominal part of the operation is seen at the upper part of the wound After two non-crushing clamps have been applied—one above and one below this level—the bowel is cut across at this site and is then free

It remains to anastomose the cut end of the colon to the ano rectal stump and this is completed in the manner described in the previous anastomoses (Fig 66) Finally the skin flap is sutured into position around a corrugated rubber drain which is passed down to the site of the bowel union

Miles s Abdomino—Perineal Excision of the Rectum and Colon

The final decision as to which operation is best for each individual is not likely to be made until the abdomen is opened and a full inspection of the extent of the growth has been carried out If an abdomino perineal excision is considered advisable we prefer to rely on the technique as originally described by Miles and not to adopt the modification of a combined excision which would entail considerable re arrangement of the patient s position on the operating table after the abdomen had been opened Moreover the mortality of an abdomino perineal excision when following the originally described principles is so low that we see no reason for its alteration

The Abdominal Dissection

The table is tilted into a very high Trendelenburg position so that all the small intestines fall into the upper part of the abdomen where they are easily retained with abdominal packs The peritoneum on either side of the root of the pelvic meso-colon and on each side of the upper third of the rectum is incised Below the two incisions are united by incising the peritoneum at its reflection on to the bladder or uterus The lateral flaps of peritoneum are separated from their loose attachment to the underlying structures and both ureters are identified and traced into the pelvis (Fig 67) The assistant holds the bladder or uterus forward by means of a deep retractor and the rectum is separated downwards as far as the apex of the prostate in the male (Fig 68) or the middle third of the posterior vaginal wall in the female In the male there is a condensation of visceral pelvic fascia situated below the peritoneal reflection from the rectum on to the bladder This septum known as the recto vesical fascia of Denonvillier requires deliberate division in a transverse plane if the correct plane of cleavage between it and the prostate is to be most readily identified

It is then best to separate the rectum from its posterior attachment This is achieved by division of the root of the lower part of pelvic meso-colon so that the hand may be passed down in a plane just in front of the sacrum stripping the bowel forwards This separation is carried down as far as the coccyx The rectum can then be drawn over to one side and the opposite lateral ligament is thus put on the stretch Its division which is carried down as far as the levatores ani muscle is thus rendered easy (Fig 68) During section of the lateral ligament branches of the middle haemorrhoidal artery will be cut across Bleeding from these structures presents no problem and is easily controlled by diathermy The rectum is next drawn over to the opposite side and the remaining lateral ligament is similarly divided

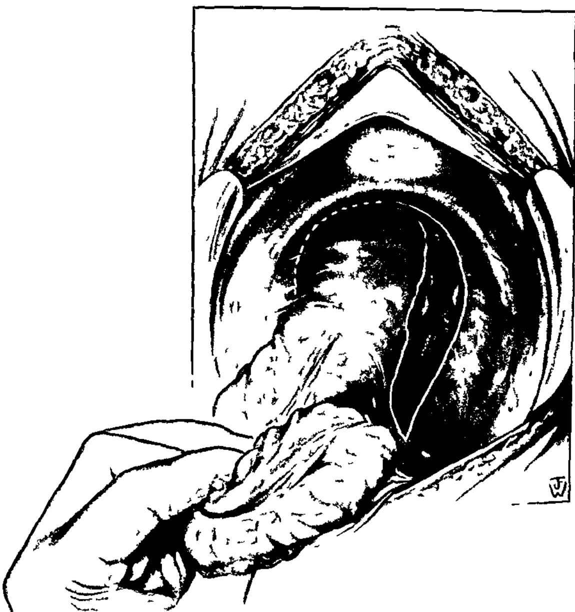


Fig 67

Abdomino perineal excision of the pelvic colon and rectum The line of incision of the peritoneum is shown To the right below the lateral flap of peritoneum the ureter is seen



FIG 68
Abdomino perineal excision The bladder is retracted and the rectum has been separated from the seminal vesicles and the upper part of the prostate The rectum is held over towards the left and the right lateral ligament thus put on the stretch is being divided



FIG 69

Abdomino perineal excision Ligation of the inferior mesenteric artery below the origin of the first sigmoidal branch The dotted line indicates the line along which the pelvic meso colon is sub sequently divided

The mobilised bowel is drawn up into the wound to tauten the pelvic meso-colon so that the branches of the inferior mesenteric artery can be identified The main artery is then tied just below the point at which the first sigmoidal branch is given off by passing a threaded aneurysm needle around it through the base of the mesentery (Fig 69) It is not necessary to dissect the artery before it is tied and the ligature will include some of the fibro fatty tissues of the meso-colon In those patients in whom the meso-colon is loaded with fatty tissues the identification of the sigmoidal branches is difficult If however the ligature is placed around the inferior mesenteric artery at the level of the bifurcation of the aorta the blood supply of that part of the pelvic colon which is to be brought out as a colostomy is always assured A second ligature is applied to the artery distal to the first and the tissues containing the artery between the two ties are divided The proximal end of the divided artery beyond the ligature is then picked up and again ligated In view of the large size of this artery the precaution of this double ligature is wise

The pelvic meso-colon is then divided between artery forceps the line of division being placed parallel and just distal to the first sigmoid artery (Fig 69) The colon at this level is crushed with a Cope s modification of de Martel s crushing clamp The bowel is then divided with diathermy between the two small clamps The surface of each clamp is swabbed with spirit as an added precaution against infection and each is then enclosed in a small plastic bag

The skin in the left iliac fossa one third of the distance between the anterior superior iliac spine and the umbilicus is picked up with a Kocher s forcep and a circle the size of a *halfpenny* is excised The skin is incised away from this circle at points opposite each other The underlying subcutaneous tissues muscles and peritoneum are divided Through this incision the clamped upper end of the colon covered with its bag is withdrawn It is held so that it is just taut and its wall is sutured accurately by interrupted sutures to the free edge of the peritoneum surrounding it (Fig 70) A few muscle and skin stitches are used to close the wound around the emerging colon The surgeon then returns to the main abdominal wound

As the pelvic colon is drawn forward to pass through the anterior abdominal wall a space is left between it and the lateral wall of the abdomen Through this a loop of small intestine could insinuate itself and become obstructed It is therefore necessary to obliterate this space This is easily effected by suturing the sero muscular coat of the emerging limb of the colon to the peritoneum of the adjacent lateral abdominal wall

The lower part of the pelvic colon is then pushed into the pelvic cavity The peritoneum is teased off from the posterior surface of the bladder when the subject is a male and from the posterior aspect of the broad ligament when a female in order to provide flaps to reconstitute the peritoneal covering of the pelvic floor Sufficient flaps may always be obtained for this purpose

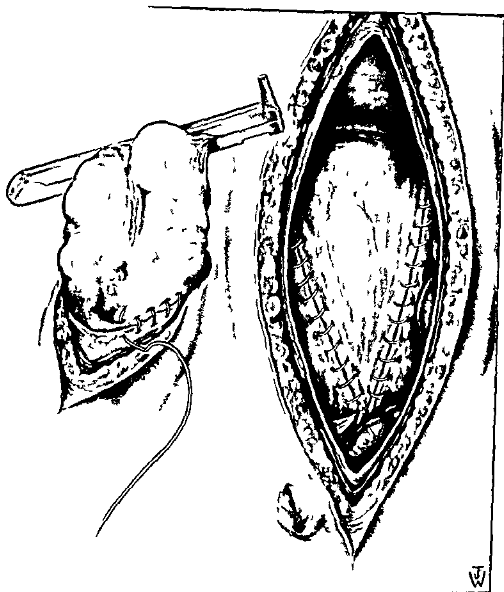


Fig 70

Abdomino perineal excision The peritoneal floor of the pelvis has been reformed The end of the pelvic colon has been brought out through an incision in the right iliac fossa and the peritoneum is being sutured to its sero muscular coat

Their edges are lifted up and sutured to the cut margins of the peritoneum of the lateral and posterior walls of the abdomen (Fig 70)

In order to minimise the possibility of any adhesions the peritoneum should be so sutured that the raw edges are everted towards the pelvic cavity Absolute accuracy of suture of this re formed floor must be achieved Any small tears in its surface must be closed so that there is no hole through which a coil of small intestine may prolapse with resulting obstruction in the post operative period

The abdominal wound is then closed Towards the end of the abdominal part of the excision a blood transfusion should always be set up In spite of the relatively small amount of blood lost during this dissection there is a tendency for shock to develop This can be minimised by transfusion therapy commenced before it has progressed to any extent In the occasional case when shock is severe at the completion of this first part of the operation the surgeon should have no hesitation in delaying the perineal dissection until recovery has taken place Such a delay of half an hour or so before the patient is prepared for the second stage of the operation is sufficient for the shock to be combated The additional time expended is amply repaid by the good condition of the patient on his return to the ward

The Perineal Dissection

The patient is gently turned on to his right side and with the knees drawn well up towards the chin the buttocks are lifted over the edge of the table The towels are suitably arranged The anus is then closed by means of a purse string suture in order to prevent faecal leakage during the perineal dissection

A circular skin incision is made surrounding the anus From its mid point posteriorly the incision is continued backwards with a slight convexity directed upwards as far as the lower segment of the sacrum It is wise to avoid an incision placed immediately in the midline as the healing of such a wound is less satisfactory When the patient sits up in the initial post-operative days such an incision tends to be stretched and its edges separate far more easily than if the skin wound were fashioned in the manner indicated The skin and subcutaneous tissue flaps are then dissected upwards and downwards to expose the edge of the gluteus maximus muscle The sacro-coccygeal joint is identified in the right extremity of the wound and a knife is inserted into this to divide the coccyx from the sacrum The coccyx is separated from its other attachments and is removed

A finger may now be inserted on either side of the rectum above the levatores ani muscle the posterior two thirds of which is divided close to its origin from the pelvis on either side The attachment of the fascia propria of the rectum to the last sacral segment (the fascia of Waldeyer) is then incised and the separated colon and rectum are drawn out of the wound Brisk haemorrhage may result at this stage from the division of branches of the

middle sacral artery This is best *controlled by an under running ligature* as retraction of the cut ends of the vessel behind the fascia covering the sacrum makes it difficult to pick them up



FIG 71

Abdomino perineal excision the perineal stage of the dissection The colon and rectum have been pulled out of the wound and the final separation from the seminal vesicles and the prostate has been completed

In front in the male a few attachments to the prostate and the seminal vesicles may remain and these are divided (Fig 71) Beyond the apex of the gland the rectum and anus are freed by division of the sling of the pubo-rectalis portion of the levatores ani muscle on either side and by cutting *through the central tendinous point of the perineum*

Separation of the ano rectal region from the vagina in the female is simple as a plan of cleavage between the two structures is readily identifiable The final dissection through the perineum is similar to that in the male

All bleeding points are then secured Venous ooze from veins in the prostatic plexus may require especial attention If there is any difficulty it is best to use an under running suture to ensure haemostasis

At the end of the dissection a very large cavity remains We think that as advised by Miles it is best to pack this lightly with a gauze roll after inserting a square of oiled silk with which to line its walls By so doing some additional support is given to the very thin pelvic floor of re formed peritoneum in the first few post-operative days and until it has become thickened with early granulation tissue Moreover the inevitable post-operative ooze from the walls of the cavity is less with this form of dressing than when the wound is simply drained with a rubber tube The oiled silk is a permeable membrane Thus all secretions are absorbed by the gauze without the latter becoming adherent to the walls of the cavity The associated disadvantages of pain at the time of its removal and haemorrhage from the granulations disturbed in this process are avoided

The ends of the packing and of the oiled silk are brought out through the middle of the perineal wound the rest of its extent being closed The accurate approximation of the skin edge is sometimes difficult but care should be taken to ensure that it is achieved Any over lap will delay healing and may give rise to a breakdown of the wound

OPERATIVE TECHNIQUE WHEN SECONDARY DEPOSITS IN THE LIVER ARE PRESENT

There is no doubt that in such cases the patient s remaining span of life is rendered far more comfortable and is usually more prolonged if the primary growth is removed The prolongation of life is sometimes remarkable and several years may elapse before diffuse invasion of the liver gives rise to hepatic insufficiency and death One of our colleagues Mr Lawrence Abel had a patient who survived nine years following an abdomino perineal excision for carcinoma of the pelvi rectal junction At the time of the operation scattered secondary deposits were present in the liver Also a patient of the author s aged eighty four at the time of a wedge excision for cancer of the pelvic colon with extension to the liver is alive and very well on his eighty eighth birthday

If a colostomy is carried out as a palliative measure or if the growth is by passed by an anastomosis of the bowel above and below the cancer the ulcer remains to produce general effects on the patient s health Bleeding although perhaps reduced continues so that the patient survives in an anaemic condition Toxic absorption from the surface of the ulcer contributes to a generalised loss of well being and as the growth extends to the surrounding structures severe pain aggravates the unhappy state of the patient

Where a colostomy has been carried out for a carcinoma of the pelvic colon or of the pelvi rectal junction the very symptoms of which the patient complained before his operation continue The discharge of blood and mucus the feeling of discomfort in the rectum and the persistent frequent desire to defaecate persist The failure of the operation to cure the condition is very apparent to the patient and his depression is understandable

Resection of the primary growth should therefore be carried out when ever possible With an increasing experience of colonic surgery the truly irresectable case becomes a rarity

Although a limited excision is all that is necessary in these patients the line of section through the bowel must not be made too close to the palpable margins of the tumour If the colon is transected through growth the subsequent end to end anastomosis may well break down Even though primary union of the bowel ends is achieved a recurrence may develop at the site before the death of the patient has been caused by extension of the liver metastases

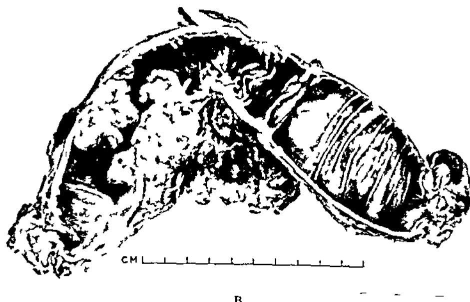
In one of our cases a limited excision was carried out for a carcinoma of the pelvi rectal junction with liver metastases Twenty months later the patient complained of a return of his original symptoms and examination showed that a recurrence was present at the anastomotic site An abdomino-perineal excision was carried out and the patient lived for a further sixteen months

Where the cancer is situated in the caecum or in the ascending colon it is best to carry out a right hemicolectomy rather than to attempt a local excision as the former procedure is the easier In all other sites the pallia tive operation consists of a local wedge excision of the region containing the growth with the removal of the adjacent portion of the meso-colon Con tinuity of the bowel is restored by direct end to-end anastomosis (Fig 72 shows the extent of these local resections) If on exploration of the abdomen the secondary deposits are found to be localised to one accessible portion of the liver the surgeon may be persuaded to carry out a wide excision of the region or even to excise one or other of the lobes of the liver There is no evidence however that such a procedure alters the course of the disease When one deposit is palpable in the liver the presence of other innumerable microscopic foci of cancer is almost certain

Operative Technique when a Growth is Adherent to the Bladder As a result of either a direct spread of the growth or inflammatory adhesions binding the two organs together the colon may become adherent to the bladder It is often impossible to distinguish which of the two conditions is responsible Where the colon lies fixed to the surface of the bladder the portion of the wall involved should always be excised with the specimen The deficiency in the bladder wall is subsequently repaired and in the post operative period an indwelling catheter is retained for ten days whilst the wound is healing



A



B

Fig. 72A and B

Limited resections from cases of carcinoma of the pelvic colon in which metastases in the liver were present at the time of operation

Carcinoma of the Left Side of the Colon—Statistics

No of cases operated on at the Gordon Hospital since 1947 for carcinoma of the left side of the pelvic colon—71

No of cases without liver metastases at the time of operation—53

No of palliative resections—18

No of cases in which radical excisions of the types described have been carried out—53

No of deaths—2 (1 coronary thrombosis 1 pulmonary embolus)

No of cases who have since died of the disease—6

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CHAPTER VIII

THE OBSTRUCTED CASE OF CANCER OF THE COLON

GENERAL Considerations Acute obstruction to the passage of faeces and flatus is a complication of the disease most often associated with lesions in the left side of the colon and Burgess (1923) has estimated that compared with the right side it is six times as common It is to be expected that such would be the case as the fluid nature of the faeces and the larger lumen of the gut on the right side are factors that render mechanical obstruction less likely

The cause of the final obstruction is often due to the impaction of faecal material in the colon the lumen of which has already been considerably reduced in size by the projecting bulk of the cancer In other cases oedema of the bowel wall the result of acute inflammatory changes in the region of the growth plays its part in the final occlusion Inflammation is commonly associated with the presence of a neoplasm and at the time of the operation for obstruction the affected area of the colon is often found to be grossly swollen and bound down to the surrounding structures by acute as well as by less *recent inflammatory adhesions The importance of this added factor of* inflammation will be referred to further in discussing the treatment of this condition

As the bowel dilates above the site of the obstruction there is a steady thinning of its wall until its texture becomes that of a fine membrane although in the later stages of the disease oedema and softening supervene The increase in intra bowel pressure mainly resulting from unabsorbed and unpassed gaseous products of faecal decomposition has then become sufficient to obstruct the venous return from the wall of the bowel Ultimately the pressure exercised on the bowel wall may be so great that the smaller arterioles also become occluded and patches of gangrene develop Untreated these will perforate with resulting localised or more commonly generalised peritonitis The backward dilation of the colon is usually most marked in the caecum and it is in this structure that the areas of gangrene are most likely to be found but they may occur at any point along the length of the dilated bowel

The ileo-caecal valve which normally prevents the retrograde passage of colonic content into the ileum resists the increase in intra-colonic pressure so that distension is first confined to the colon and caecum but it may eventually yield with resulting dilation of the distal loops of small intestine The symptoms of low small gut obstruction will then add themselves to those of obstruction of the large bowel and as the distension proceeds through the ileum those of upper small bowel obstruction will if left untreated rapidly cause the patient s death

It must not be overlooked that small bowel obstruction may complicate the clinical picture although the ileo-caecal valve still retains its function This can occur as the result of inflammatory adhesions binding the small intestine to the region of the neoplasm and kinking the gut at this site This complicating pathology is also of great importance when the question of treat ment is considered

Symptoms and Diagnosis It must be remembered that the patient with large bowel obstruction is in the initial stages surprisingly well although perforation the result of a gangrenous patch in the bowel wall may be imminent He or she may walk into the consulting room or outpatient depart ment as the following case illustrates *with no superficial appearance of being* in need of urgent treatment

Case 7 A W Male aged sixty eight Walked into the casualty department complaining of constipation which had been complete for four days In spite of this he had been at work until the evening of his attendance Flatus had been passed he believed in the first part of this period but not in the last forty eight hours On questioning he admitted to increasing difficulty with his bowels over the previous six months and had noticed blood smeared over the stool on several occasions Examination revealed a grossly distended abdomen with some tenderness over the caecum and at operation the obstruction was found to be due to a carcinoma of the pelvic colon Routine inspection of the large intestine showed that there was a patch of gangrene in the anterior wall of the caecum the result of its considerable distension Instead of a transverse colostomy a caecostomy was performed the exteriorised area including the gangrenous patch The latter was subsequently excised to provide the stoma At a later date the growth was resected

Absolute constipation may be present for several days whilst the patient still remains at his or her normal duties and it is not until perforation results or the vomiting of a small bowel obstruction supervenes that the condition rapidly deteriorates

In our experience all cases presenting with acute obstruction have suffered from some of the symptoms referred to in Chapter III before the onset of this complication It is true that these may have seemed trivial to the patient and because of that they have passed unreported and almost unnoticed but close questioning will always elicit evidence of their presence in the past The final symptom that usually brings the patient to the clinician is that of absolute constipation though in more advanced cases vomiting has commenced before the patient finally seeks medical aid Some patients will have noticed no flatus but in others in whom the obstruction is not absolute it continues to be passed Colicy pain is common and a diffuse tenderness or soreness of the abdomen is often complained of with accompanying fullness and distension

In the thin subject the diagnosis is usually easy The history suggests the cause and the examination of the patient and especially of the abdomen revealing distension and usually visible peristalsis supports the diagnosis In those patients in whom the ileo-caecal valve has remained intact the swelling

of the abdomen is principally confined to the lateral and subcostal regions where the large bowel lies A distended pelvic colon rising into the centre of the abdomen however may easily be confused with distension of the small intestine Observation of the pattern of the peristalsis may serve to distinguish the two the zigzagging or ladder type associated with the small bowel being very different from the longitudinal waves associated with the pelvic colon Both types of peristalsis may be present when the obstruction has extended backwards to involve the small intestine or where this structure is separately obstructed by the pathology previously explained

Percussion of the abdomen will help in confirming the identity of the regions of the distended bowel being normal towards the centre of the abdomen and grossly tympanitic over the areas of the large intestine in those patients in whom the large bowel alone is affected When the small intestine too becomes dilated the abdomen is uniformly hyper resonant Palpation may possibly reveal a mass but its presence may be obscured if it lies under the costal margin or in the pelvis and distended coils of bowel will add to the difficulty in its localisation This method of examination must be conducted with extreme gentleness and no great pressure should be brought to bear on the abdomen in an endeavour to identify a swelling for fear of injury to the extremely fragile underlying bowel Areas of especial tenderness may suggest gangrenous areas in the wall of the colon or caecum with localised peritonitis

Rectal examination must always be carried out and the growth may be palpable In the absence of a palpable tumour ballooning of the rectum will suggest an obstructive lesion in the lower colon and blood or discharge on the examining finger will add evidence in favour of the presence of a neoplasm Gentle bimanual examination may sometimes enable a growth to be palpated which on plain abdominal or rectal examination could not be identified

These findings on abdominal examination are often considerably obscured in the obese patient and it is in such that the diagnosis may be missed Careful examination however will reveal abnormalities of the kind described above and a detailed history will lend aid to the diagnosis In any case of doubt the patient must be admitted to hospital for further observation

The advanced case of obstruction in which the condition has progressed so that gross ileal distension with repeated vomiting and rapid dehydration is present is now fortunately rare but the occasional case may need differentiation in the diagnosis from those in which the obstruction is primarily in the small intestine Again the previous history of the patient and the routine examination described will help the clinician when forming his conclusions

Although the diagnosis will usually be evident a straight X ray of the abdomen is useful This will not only confirm the diagnosis by showing the loops of colon distended with gas (Fig 73A and B) and where the small intestine is involved distension in this region as well but it is also an aid in identifying the site of obstruction where this has not been determined as a result of the examination of the patient The gaseous shadows of the dilated



A



B

Fig 73A and B

Straight X rays of the abdomen anterior and lateral views showing the enormous distension of the bowel above a carcinoma of the pelvic colon

gut shown in the X ray will stop abruptly at the margin of the neoplasm and its position in the colon can therefore be identified with some accuracy The surgeon is therefore able to plan his operation for the relief of the obstruction before opening the abdomen This preliminary X ray is of particular value in those patients who are so desperately ill that a simple colostomy without an associated exploratory laparotomy is considered the best form of treatment

Treatment It has been remarked that many of these cases with acute obstruction are surprisingly well and in view of this it may be thought justifiable to attempt to relieve the immediate condition by enemata and colonic irrigations When constipation has been absolute for several days and when it has been associated with abdominal distension we consider that this should not be a treatment that replaces urgent operation Our experience in such cases has shown that it is not possible to relieve the obstruction completely or to empty the bowel of all its contained faeces to the extent that is necessary to carry out one of the resections with immediate anastomosis as described in Chapter VII Preliminary decompression will be required prior to these procedures

Moreover as noted above a patient with acute obstruction may be in imminent danger of perforation of the colon and subsequent general peritonitis although at the time of the examination he appears well Delay in operation may precipitate this perforation and in addition added distension of the colon produced by the irrigating fluid may actually cause the rupture of a gangrenous patch of gut with disastrous results Finally if there is an obstruction in the ileum the result of adherence of this structure to the growth *the condition will not be relieved by irrigations even though that in the large* bowel may be overcome and the accompanying delay in its relief may prove fatal to the patient We therefore consider that all patients suffering from an acute obstruction or from a marked degree of subacute obstruction if otherwise fit and well should be subjected to immediate operation

The patient who is desperately ill in whom the obstruction has involved a considerable length of the small intestine and whose symptoms have included copious vomiting is obviously in no fit state to withstand any operative procedure and conservative treatment must be given as a preliminary measure in an endeavour to make him fit for operation Intravenous fluids must be set up and if the chloride or potassium loss in the vomit has been excessive as revealed by estimation of the plasma values then solutions of these salts should be used instead of the customary glucose saline mixture Where there is an associated anaemia or any degree of shock blood transfusion is given Stomach suction through a Ryles tube is instituted and enemata administered *in an effort to relieve the obstruction* and tide the patient over the crisis even though the danger mentioned above of employing this procedure is appreciated Streptomycin is given in all cases in order to minimise the danger of peritonitis

In spite of such treatment some patients may not recover sufficiently to allow any operation to be carried out but others will improve in several hours so that limited operative measures may then be undertaken for the relief of the obstruction

Between these two extremes of cases there are those who may well benefit by pre-operative intravenous fluid or blood transfusion therapy but as the obstruction is to be relieved by operation we consider enemata in such cases undesirable If the patient has vomited a Ryles tube must be passed and the stomach emptied by aspiration before any anaesthetic is administered

THE CHOICE OF OPERATION

It is necessary to review the various procedures that are at the surgeon s disposal in dealing with this condition and to consider the advantages and disadvantages of each before deciding on an operative plan best suited for the treatment of low bowel obstruction the result of carcinoma In view of the high fatality of this complication stated by Morley (1951) to be between 26 per cent and 34 per cent in series recorded in the decade 1940/50 the importance of this consideration will be very evident

Simple Decompression Smith (1951) suggests that following localisation of the site of the growth by straight X ray of the abdomen a simple decom pression operation behind the site of the obstruction should be carried out in all cases with the exception of those carcinomata occurring in the caecum when an ileo transverse colostomy remains the method of choice Thus in carcinoma of the left side of the colon transverse colostomy is performed and a caecostomy in those patients in whom the lesion is sited in the right half of the colon No exploratory laparotomy is undertaken at the time of the latter decompressions which are carried out through small incisions placed over the portion of the bowel to be exteriorised Smith believes that exploration is accompanied by the danger of rupture of the distended bowel the wall of which is either greatly thinned or friable and oedematous

There is no doubt that this method of treatment is the most desirable in the very ill patient in whom the chances of survival are greater if minimal operative procedures are undertaken but in the fitter patient we consider that it carries more dangers than those it seeks to avoid If patches of gangrene are present in the wall of the distended bowel they remain unrecognised and undealt with and they are certain to perforate and give rise to general periton itis if they remain untreated In addition an associated obstruction of the small intestine due to the causes described above will not be recognised and although that of the large bowel will subside that in the small gut will progress and cause the death of the patient When dealing with the ill patient these risks must be accepted but they are not justifiable when the patient is able to stand a more extensive operation

The danger of rupturing the wall of the distended colon during explora tion is minimal if gentleness in handling the gut is exercised throughout the

operation Moreover the enormous distension that often exists is largely gaseous and this may be relieved with safety at the commencement of the exploration by puncturing the bowel with a wide bore needle connected by rubber tubing to a suction apparatus The puncture is best made in the proximal part of the transverse colon as if a transverse colostomy is established at the completion of the operation its site can then be exteriorised with this After suction has deflated the colon the needle is withdrawn and the minute puncture in the bowel wall is closed by purse string sutures

There is no need to carry out an extensive examination of the abdominal contents at the time of the exploration All the surgeon wishes to know is whether there are any patches of gangrene on the wall of any part of the colon or caecum behind the growth so that they may be dealt with and whether the small intestine is obstructed in any way by adherence to the neoplasm in order that this obstruction too may be relieved More than a cursory examination of the tumour itself is unnecessary and no opinion can be expressed at this stage with regard to the operability of the growth The added inflammation and oedema associated with the obstruction make it quite impossible to assess what part of any fixity and extension is due to this cause and what is due to actual infiltration of the neoplasm A second exploration will always be necessary to decide these points Palpation of the subcostal surface of the liver with a view to ascertaining whether secondary deposits are present should never be carried out At the time of operation on a case of acute obstruction of the colon infection of the general peritoneal cavity is likely to have commenced and this infection may be introduced into the subphrenic regions if the operator s hand is passed above the liver

The Inadequacies and Disadvantages of a Paul Mikulicz Type of Operation Perhaps the most common operation performed in the treatment of acute obstruction is the Paul Mikulicz exteriorising procedure or one of its modifications In Chapter IV we have put forward reasons for our conclusion that this operation is not sufficiently radical in its removal of the area of lymphatic drainage for a carcinoma arising in the colon and these arguments are equally applicable against its use in dealing with the acutely obstructed case In many of these patients no evidence of invasion of the para aortic lymph nodes or of secondary metastasis to the liver is present and because the patient is suffering from a complication of the disease the surgeon is not absolved from planning a line of treatment that offers the patient the best chance of cure not only from his present acute obstruction but also from his disease Moreover in the Paul Mikulicz operation the bowel may well require mobilisation before it can be brought on to the surface of the abdominal wall particularly when the growth is situated in the flexures in the ascending or descending colon or in the lower part of the pelvic colon The procedure entails incision of the peritoneum and the opening up of retro peritoneal spaces which if infection is present in the general peritoneal cavity may themselves readily become infected

Finally the operation is not brief and a consideration in the recovery of these patients is the rapidity with which any procedure designed for the relief of the obstruction can be carried out On these grounds the operation should be abandoned if simpler methods of relieving the obstruction with safety are available and if by staged operations a more radical removal of the area involved in the disease can be achieved In the paragraphs that follow such methods are discussed

The Relief of the Obstruction and the Radical Excision of the Carcinoma by Staged Treatment The first stage consists of a preliminary exploratory laparotomy at which not only is the obstruction relieved by a colostomy caecostomy or short circuit operation according to the site of the growth but in addition any associated complication is dealt with If an area of gangrene is present in the wall of the bowel it may be possible to oversew this by purse string sutures after the bowel has been decompressed by the needle and suction method Should the area be at all extensive it is wise to plan the colostomy or caecostomy to include the gangrenous patch This region of the bowel is thus exteriorised and any danger of an intraperitoneal leak in the post operative period is prevented

If the small gut is adherent to the growth and as a result has become obstructed it must be separated from the adhesions when possible In so doing it may well be opened and the perforation will require repair Occasionally the small intestine may be inextricably bound down to the growth and its surrounding area of inflammation and if obstruction is present it is wise to relieve this by a short circuit anastomosis rather than by embarking upon a prolonged and hazardous attempt to effect separation of the involved loops These may be dealt with far more easily several weeks later when the growth is resected for by that time the inflammation will have subsided and their separation will then be comparatively simple

After an interval of two or three weeks a radical removal of the carcinoma as described in the previous chapter is carried out and finally after a further interval of time the colostomy or caecostomy if present is closed

Most patients in whom the cancer is situated in the left side of the colon and they are the large majority will therefore be subjected to a three stage procedure for their cure and it may be argued that in older patients three anaesthetics add unjustifiable hazards to their recovery With modern methods of anaesthesia experience has shown that such criticism is of theoretical but not practical application and the important initial anaesthetic administered to a patient suffering from an acute intra abdominal emergency is in the three stage procedure short The second more prolonged anaesthetic is given to a patient who has recovered from the acuteness of his illness and who has had a period of pre-operative preparation designed to minimise post-operative complications so that their rate of incidence is small The final anaesthetic for the closing of the colostomy is also short and not of great depth

OPERATIVE DETAIL

1 Obstruction due to Carcinoma of the Caecum or Ascending Colon In this obstruction an ileo transverse colostomy is the operation of choice an iso-peristaltic anastomosis being carried out between a portion of the ileum some few centimetres from the ileo-caecal valve and the proximal third of the transverse colon Only if the caecum contains an area of gangrene in its wall is a caecostomy performed

Where gross distension of the small intestine is present this must be relieved by the needle and suction method described above before the anastomosis is undertaken If attempts are made to suture the thinned intestinal wall without carrying out this manoeuvre it will be found that it is almost impossible to confine the first layer of approximating sutures to the sero muscular layer of the small bowel Each stitch tends to enter the lumen of the gut so that multiple minute points of perforation result through which leakage can occur in the post-operative period with accompanying complications of local or general peritonitis The needle is inserted into the bowel in the line through which the intestine is to be opened This small puncture wound will then be included in the suture lines and there can be no possibility of post-operative leakage as a result of the insertion of the needle Following decompression the thickness of the wall of the intestine rapidly returns to a degree that enables the stitches to be inserted without any danger of their entering into the lumen of the bowel

The anastomosis is carried out in two layers in the manner described in Chapter VII with the difference that where speed of operation is considered urgent the initial line of sutures approximating the sero-muscular layer is a continuous one instead of consisting of interrupted sutures which for preference are employed The abdomen is closed without drainage

2 **Obstruction due to Carcinoma of the Hepatic Flexure** In order to extirpate all regions potentially infiltrated with carcinoma radical excision at a subsequent operation will involve removal of the caecum and the ascending and transverse colons A short-circuit operation made to a point beyond the region of the large intestine subsequently to be resected would involve an anastomosis between the small intestine and the splenic flexure Such an operation would require considerable manipulation of the bowel and would possibly necessitate the mobilisation of the upper part of the descending colon and the splenic flexure in order that the latter could be drawn into the operative field for the purpose of the anastomosis An operation of this type is ill advised as not only is it time consuming but manipulation of the bowel and the opening up of tissue planes is contra indicated in the presence of acute obstruction when it can be avoided Caecostomy is therefore the procedure of choice in the relief of obstruction due to a growth in the hepatic flexure

If any areas of early gangrene are present in the dilated colon or caecum they are best oversewn before the caecostomy is carried out and if gross

distension of the colon is present it must be reduced by the needle and suction method referred to on page 127 before this oversewing is undertaken

THE FORMATION OF A CAECOSTOMY In some patients in whom there is little fat and in whom the caecum is almost completely surrounded by peritoneum bringing that organ on to the surface of the abdomen through a separate stab incision is an easy procedure In others however in whom the opposite conditions are present some mobilisation of the caecum achieved by incising the peritoneal reflection on to the lateral wall and by separating the loose posterior attachments is essential in order to make this feasible Preliminary decompression by needle suction will again make the process of mobilisation easier and will minimise the risk of any rupture of the bowel in all cases where distension is great

That part of the caecum which is to be exteriorised usually the antero lateral surface must be brought well out on to the abdominal wall and the peritoneum is sutured to the base of the protruding knuckle by closely placed interrupted sutures These sutures are important not only in anchoring the caecum which has a tendency to retract into the abdomen but also in preventing any faecal content from spilling into the peritoneal cavity The exteriorised bowel is also sutured to the skin

Following closure of the laparotomy incision the caecum is opened and a right angled wide bore glass tube to the free end of which is attached a long length of Paul s tubing is passed into its cavity and maintained in position by a purse string suture of thread Although this tube rarely stays in position for more than a few days this period is sufficient to allow adhesions to form between the caecum and the layers of the abdominal wall so that the danger of spread of infection in those layers the result of faecal contamination is minimal Subsequently the discharges from the caecostomy are best collected in a disposable ileostomy bag

3 **Obstruction due to Carcinoma of the Transverse Colon** There are two methods of relieving such an obstruction either by the formation of a caecostomy or alternatively by instituting a colostomy placed in the proximal portion of the transverse colon behind the growth There is no doubt that in the few weeks that the patient has to wait until the final excision is undertaken he is far more comfortable with a colostomy than with a caecostomy The latter tends to discharge its semi fluid stool constantly whereas the more solid effluent from the colostomy discharges infrequently In addition the ileal content pouring from the caecostomy is more likely to digest the surrounding skin so that special measures are necessary to prevent this Disturbances of fluid and saline balance are also more common in the presence of a caecostomy on account of the liquid nature of the faeces at this level All these disadvantages may be overcome but still more important is the fact that where a transverse colostomy has been made it is possible by means of colonic irrigations into the proximal and distal loops of bowel to clear the colon of all its retained faeces prior to the subsequent resection With a

caecostomy such complete emptying is not possible by irrigations through this route

It is obvious that if a transverse colostomy is established close to the growth there is a very real danger of giving rise to implants in the abdominal wall through which the bowel protrudes but if there is a sufficient length of colon between these two regions that danger is avoided We therefore carry out a transverse colostomy in those cases in which a full 8 cm of intervening bowel exist between the proximal palpable edge of the tumour and the distal margin of the area of bowel it is proposed to exteriorise In all other cases a caecostomy is performed

It is sometimes suggested that the subsequent extirpation of the trans verse colon is hindered by the presence of a colostomy in the region of the bowel that is to be excised In practice the added difficulties are slight and all that is required is to close the colostomy and to separate it from the abdominal wall immediately prior to proceeding with the excision The bowel will have been well prepared prior to this last operation and there is no danger of peritoneal soiling The third stage of colostomy closure is of course avoided in such cases

4 **Obstruction due to Carcinoma of the Left Side of the Colon** Except in the case in which at operation a large patch of gangrene is found in the caecum when a caecostomy which includes the gangrenous patch should be established a transverse colostomy is the operation of choice for the relief of obstruction in the large bowel due to a lesion beyond the transverse colon

The reader referring to the previous chapter will appreciate that if the cancer involves the splenic flexure subsequent radical excision will necessitate the removal of the whole of the transverse colon so that immediately prior to this resection the closure of the colostomy and its separation from the abdominal wall will be required In cases where the growth is situated distal to the splenic flexure the transverse colostomy provided it has been established well to the right side of the colon does not usually interfere with the mobilisa tion of the distal transverse colon when the latter is brought down for anastomosis to the rectum in the course of the radical excision Nevertheless there are occasions in which its closure will be required before the anastomosis can be completed It may therefore be argued that in all such cases a caecostomy should be used to relieve the obstruction so that the defunctioning stoma would not require closure at the time of the radical excision or interfere in any way with its performance For reasons discussed in the previous section however we consider that a transverse colostomy is the more preferable procedure for the relief of obstruction due to a lesion in the left side of the colon

THE FORMATION OF THE COLOSTOMY Although the colostomy may be established at the upper end of the laparatomy wound it is best to bring it out through a separate incision so that the former may be protected more easily by suitable dressings from contamination and infection when the bowel commences to act An upper longitudinal incision about 5 cm in length

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lying freely in the peritoneal cavity generalised peritonitis may result whereas in the extra peritoneal closure any leakage easily discharges on to the skin surface

It must be remembered that there is certain to be some residual oedema of the bowel wall at the site of the colostomy in addition to some fibrosis The surgeon is therefore dealing with tissues which are not absolutely normal and leakage from the occasional case of intraperitoneal closure is responsible for the low but definite mortality associated with the repair of a colostomy It is indeed true that the development of an incisional hernia at the site of an extra peritoneal closure is more common than it is following intraperitoneal closure where better approximation of the layers of the abdominal wall is possible Nevertheless it is better to accept the possibility of this development which is easily repaired rather than subject the patient to any risk at the time of the closure of the colostomy

OPERATIVE TECHNIQUE An incision is made surrounding the colostomy just outside the junction of the bowel mucosa and the skin The rim of muco-cutaneous tissue thus left attached to the colostomy is cut away so that a fresh edge to the colostomy opening is prepared The skin incision is extended upwards and downwards away from the colostomy The emerging limbs of bowel are now freed from the muscle that surrounds them great *care being taken at this stage to preserve the attachment of the peritoneum* to the colon and thus to maintain an intact peritoneal cavity

The opening in the colon is then closed by means of an inversion suture and this is oversewn with interrupted sero-muscular sutures of linen thread The edges of the rectus muscle which have been freed from their attachment to the subcutaneous tissues are sutured over the closed colostomy with inter rupted stitches and the skin edges are loosely approximated Slight infection of the wound is not uncommon in the post-operative period but faecal dis charge is rare If this does occur however the resulting fistula usually heals spontaneously

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is therefore made just to the right of the midline The incision cuts through all layers of the abdominal wall in the same plane so that the rectus muscle will be incised in the direction of its fibres The region of the colon to be exteriorised is then chosen and it must be so situated that when it is brought out on to the surface of the abdomen the proximal limb of the transverse colon lies just taut If a large loop of colon is left between the hepatic flexure and the proximal end of the colostomy there is the danger that it may intussuscept through the colostomy in the post operative stage

Before bringing the selected loop of colon through the incision it is separated from the great omentum for a few inches In addition the appendices epiploicae attached to the bowel in this region are ligated at their points of attachment and are removed If they are left they become swollen and inflamed in the post operative period and produce a colostomy that is more difficult to keep clean A far neater colostomy will result in their absence

When the colon is brought on to the surface a solid tube is passed through its meso-colon and maintained in position by a piece of rubber tubing connecting its two ends The peritoneum is then sutured accurately to the emerging limbs of the colon and to the meso-colon that lies between them A few skin stitches complete the operation apart from the opening of the colostomy which is carried out as soon as the abdominal incision has been closed

The Closure of a Colostomy

Three weeks will probably elapse after the colon has been excised before the closure of the colostomy completes the final stage of the planned treatment of an obstruction due to cancer of the left side of the colon For three days prior to the operation the patient is given a course of guanimycin by mouth and at the completion of each daily irrigation of the colostomy 90 cc (3 oz) of a 5 per cent suspension of phthalyl sulphathiazole are instilled into each of its limbs Sterilisation of the large intestine is thus achieved and the risk of infection or break down of the suture line in the transverse colon subsequent to its closure is minimised

The surgeon has to decide whether the closure of the colostomy is to be an intra or an extra peritoneal one In the former the peritoneal cavity is deliberately opened and the peritoneum is separated from the bowel wall On completion of the closure of the colostomy the colon lies freely in its normal position inside the peritoneum In the latter care is taken to ensure that the adherence between the peritoneum and the colon at the site of the colostomy remains intact and separation of the bowel from the skin and the muscular layers of the abdominal wall only is effected When the closure is completed the suture line in the transverse colon remains outside the general peritoneal cavity and is subsequently covered by the approximation of the recti muscles

We consider that the extra peritoneal type of closure is preferable to the intraperitoneal as in spite of every preliminary anti biotic and chemotherapeutic precaution that is taken there is a slight risk of leakage through the line of suture or even of its partial breakdown Should this occur with the colon

solution containing 4 3 per cent of glucose and 18 per cent of sodium chloride is employed This solution given in quantities of about 3½ litres in each twenty four hours usually contains sufficient sodium chloride to replace that lost in the body excretions In addition it contains the glucose which provides valuable calories during the first few post-operative days when none are being taken by mouth

3 **Electrolyte Replacement** (*a*) SODIUM CHLORIDE To ensure that an adequate intake of sodium chloride is being maintained periodic estimations of the plasma chlorides are carried out These are of especial importance in those patients in whom as a result of ileus or obstruction gastric suction has been set up The resulting chloride loss in the aspirations from the stomach is in such cases severe and the amount administered in the glucose saline mixture of the strength noted above may not be sufficient for its replacement If the plasma chloride estimation is below the average value of 95 110 m -eq / litre transfusion of normal saline solution must be instituted until once more the chloride balance has been restored

Where the patient s post-operative progress is completely uneventful the adequacy of a sufficient chloride intake may be estimated by testing the urine for the presence of chlorides If in such cases a marked precipitate results on adding silver nitrate to each specimen of urine the clinician may assume that the chloride intake is sufficient but if the precipitate is absent or slight the next bottle of glucose saline should be replaced by one of normal saline A single bottle will usually result in a return of chlorides to the urine in normal concentration

Intravenous fluid and salt replacement are continued until normal peri stalsis returns It is only by regular examination of the abdomen with the stethoscope that this restoration will be recognised at an early stage as for some time after it has been established the patient does not indicate its presence by having his bowels open or even by passing flatus Unless auscultation of the abdomen is adopted as a routine intravenous therapy will often be con tinued quite unnecessarily for prolonged periods

(*b*) POTASSIUM DEFICIENCY The importance of potassium deficiencies following major operative procedures in which a normal diet is withheld for several days is being increasingly recognised This post operative deficiency may be accentuated if owing to a poor food intake and to cellular breakdown associated with the disease in the pre operative period the intracellular potassium is already depleted (Howard and Carey 1949)

According to the investigations of Lans Stein and Meyer (1952) the aspirate from gastric suction contains 4 6 m -eq /litre of potassium and the discharge from a caecostomy 8 2 m eq /litre In colonic surgery therefore post operative depletion of this element can occur where gastric suction is of necessity continued for several days or where a caecostomy has been used to decompress an obstructed bowel The same authors describe seventeen cases maintained on gastric suction with glucose saline fluid replacement all

CHAPTER IX

POST-OPERATIVE CARE AND THE TREATMENT OF POST-OPERATIVE COMPLICATIONS

MUCH of the post operative treatment to which the closest attention must be given in this all important period in the recovery of the patient *is common to all the operations described although certain* details will vary with the different types In this chapter therefore the principles of the treatment applicable to all cases will be discussed and where the various operations require any special post operative measures these will be noted

1 **Shock** The majority of the patients will have had a blood transfusion set up in the theatre towards the end of the operation The surgeon is ill advised to delay this transfusion until any severe shock has developed and it should be commenced as soon as the anaesthetist records a fall in the level of the blood pressure noted at the commencement of the operation Severe shock at the completion of any of the operations described is rare but if present the patient should not be removed from the operating table until with transfusions and warmth recovery has taken place Then the patient should be transferred to the bed which has been brought up to the operating theatre In a shocked patient or in one just recovering from this condition a double move first from the operating table to the theatre trolley and then from the trolley on to his bed in the ward may produce a further lowering of the blood pressure with the possibility of a fatal result On occasions it may be necessary to keep the patient in the theatre for periods of up to an hour before sending him to the ward Any inconveniences caused by this delay are well rewarded by a recovery more rapid than if he had been sent immediately The few who have not been transfused in the theatre will mostly benefit by a small blood transfusion on their return to the ward and in the remainder the blood is continued until all shock has been combated

2 **Intravenous Fluid Replacement** As in all cases nothing except small sips of fluid will be taken by mouth in the first few days of post-operative treatment the blood transfusion is followed by one of glucose saline Normal saline must never be used for prolonged transfusion as the large quantities of sodium chloride thus administered are *not readily excreted by the kidneys* and are retained in the intercellular tissue spaces The balance of the osmotic pressure of the tissues is then restored by the absorption of water and such quantities are attracted into the tissue spaces that extensive oedema may result Whilst this causes little trouble elsewhere when it occurs in the lungs these organs may become so waterlogged that oxygenation of the blood is rendered impossible and death may ensue This danger is not present if an isotonic

4 **Post operative Ileus** The period of natural ileus subsequent to these abdominal operations seldom lasts more than three or four days but when the procedure has been extensive or where an obstruction was present prior to operation it is likely to extend beyond this normal duration In such cases the abdomen will become distended and the patient will commence to vomit large quantities of the brownish secretions with which the small intestine rapidly fills Before the distension is severe gastric suction must be set up and the stomach contents aspirated at hourly intervals For this purpose the use of a Ryles tube is usually sufficient and the Miller Abbot modification is rarely employed The manipulation of the latter tube through the duodenum requires considerable alterations in the positioning of the patient in bed and X ray confirmation that the end of the tube has passed into the intestine and has not coiled up in the stomach The ill patient is disturbed by these manoeuvres and as equally good results are achieved in simple ileus with the Ryles tube the point of which seldom reaches beyond the pyloric region of the stomach we have abandoned its routine use The Ryles tube should be passed through the nasal route where its presence causes little discomfort even though maintained in position for many days and it is removed only when peristalsis once more returns

When ileus is prolonged the absence of any protein intake results in a steady diminution of the plasma proteins and in spite of a high haemoglobin estimation further blood transfusion is of the greatest value in restoring them to normal The improvement in the patient s general condition is often dramatic following such a transfusion and it should be given if ileus has persisted for five days

Throughout this period of ileus nothing is given by mouth with the exception of a teaspoon of water at hourly intervals when the patient is awake This small quantity of fluid added to the saliva that the patient inevitably swallows and which is quickly aspirated through the Ryles tube does no harm and serves to alleviate in some measure the thirst from which all patients complain when liquids by mouth are withheld for any length of time

There are rare cases in which in spite of this treatment the ileus continues and the condition of the patient slowly deteriorates In such cases we consider the use of intravenous pituitrin as life saving (Aylett 1938) 1 cc diluted with 9 cc of normal saline is slowly injected As soon as the patient complains of abdominal pain the injection is stopped and in a short time the violent passage of flatus and intestinal content will usually occur If the colicy pains cease without visible or audible effect the full dosage is administered and in cases of pure ileus this injection will always produce results Following the initiation of intestinal activity peristalsis usually returns to normal rapidly and very rarely will a second injection of the drug be required

Although this method of treatment was frequently employed before the introduction of gastric suction and routine intravenous transfusion the rare occasion when a patient does not respond to the latter therapy is indicated

of whom developed severe potassium deficiency Similar deficiencies were noted as a result of potassium loss through the discharging intestinal content not only from caecostomies but from colostomies as well

The symptoms associated with deficiency of this element are according to Eliel Pearson and Rawson (1950) those of apathy lethargy nervousness and irritability muscular weakness abdominal distension occasional confusion disorientation delirium muscular twitching and tetany electro-cardiographic changes and occasional arrhythmias and oedema' To these Lans Stein and Meyer add anorexia and nausea and shallow respirations

The whole galaxy of symptoms are of course present only in the severest cases of deficiency and as Black (1953) has emphasised many may be due to a general distortion of cell biochemistry rather than to potassium lack alone In view of the danger of the intravenous administration of potassium salt solutions where such depletion *is not present these symptoms should not be* attributed to potassium lack alone unless the serum potassium value is lowered It is known that although the serum potassium may be within normal range the intracellular value may be reduced Nevertheless a fall in the former *reading must be awaited before potassium is administered intravenously and* the salt must never be given on a consideration of the symptomatology alone No harm will come to the patient if in a case of suspected potassium deficiency daily estimation of the serum value are carried out and if replacement *is commenced only when a value is present below the lowest value of* normality which according to Wootton King Smith and Haslam (1951) is 3 5 m-eq /litre During this waiting period the fluid and sodium chloride balance of the patient must be checked in order to eliminate the possibility *that deficiencies in this direction are the cause of the symptoms*

If intravenous potassium replacement is decided upon the solution used should not exceed a strength of 40 m-eq of potassium per litre and the rate at which it is administered must be restricted to 1 litre in three hours The administration *of higher concentrations of the element or of the lower con*centration at an increased rate may cause cardiac irregularities or even arrest of the heart beat A solution of 3 g of potassium chloride per litre is therefore used and in severe cases of the deficiency up to 15 g in twenty four hours may be given (Lans *et al*) In our own experience *of mild deficiencies clinical* improvement and the restoration of the serum potassium has resulted from a single litre of the solution repeated on successive days Lans *et al* also emphasise that the transfusions should be continued for five days after the *serum potassium has been restored to normal values if the patient is* unable to take the salt orally Reappearance of the symptoms for which the patient is being treated may well reappear if the salt is discontinued earlier

If after the serum potassium has been restored to normal by intravenous therapy *oral administration is possible before the end of the five day period* 0 9 g (15 grains) of potassium chloride are given six hourly (suitably dispensed with flavouring agents) for twenty four hours and then three times a day until the elapse of the given period

8 **Early Mobilisation** Although the patient is encouraged to move about in bed on the first post-operative day when massage and breathing exercises under supervision are commenced we prefer to delay his getting out of bed until the third day At first the patient sits out only whilst the bed making is taking place but the periods up can be increased fairly rapidly and the effect on the morale of the patient apart from diminishing the risk of thrombosis formation is great Only if ileus is severe is this early mobilisation postponed

9 **Initial Feeding** Feeding by mouth commences as mentioned above as soon as normal peristalsis has returned For the first twelve hours 1 oz of water is given hourly followed in the next twelve by a mixture of equal parts of milk and water During the second twenty four hours each feed is increased to 2 oz Thereafter feeds may be rapidly built up both in size and variety but for the first forty-eight hours it is wise to adhere to the limited quantities of fluids recommended as if too big feeds are given there is the danger that the ileus may return perhaps necessitating further intubation and intravenous therapy

10 **Care of the Perineal wound of an Abdomino Perineal Excision** In the patient who has had an abdomino perineal excision the packing is removed at the end of seventy two hours By this time a firm layer of fibrin will have formed on the under surface of the peritoneal floor of the pelvis and on the lateral walls of the large cavity which remains after the excision Irrigations of the cavity can then be commenced without the risk that the irrigating fluid may pass into the retroperitoneal tissues or even into the peritoneal cavity The irrigations are necessary in order to wash away the blood clot and fibrinous debris that are always present and which if left are likely to become infected They are best carried out with the patient lying on his right side with his buttocks well over the edge of the bed the latter being protected by a mackintosh covered with a sterile towel (Fig 74 75) The cavity is irrigated by passing a rubber catheter well up into its depths and by means of an attached container running into it firstly 500 cc (approx 1 pint) of a 1 in 4 solution of 10 volume hydrogen peroxide then 500 cc of a solution of 1 in 1 000 perchloride of mercury and finally a similar volume of normal saline The hydrogen peroxide disturbs any adherent fragments of clot or fibrin by the physical effect of its effervescence whilst the perchloride of mercury acts as an antiseptic lotion and in addition forms a precipitate on the surface of the wound which tends to diminish the ooze from its very great surface area The final irrigation with the normal saline washes away any excess of the perchloride solution

These irrigations are carried out daily for ten days at the end of which time the patient is allowed up for a daily bath The irrigating fluids are then changed to 1 litre (approx 2 pints) each of half strength Eusol and 1 in 4 lotio Rubra and these are continued until the depth of the perineal wound has diminished to about three inches Thereafter irrigations are unnecessary and final healing is completed about six weeks from the date of the operation

by the fact that since the war we have used intravenous pituitrin in colonic surgery only once In this patient upon whom an abdomino perineal excision had been performed a completely silent abdomen had been present for eleven days towards the end of which period his general condition was deteriorating quickly Following the administration of the drug normal peristalsis rapidly returned In no other cases upon whom the operations described have been performed in the post war period has post operative paralytic ileus failed to respond to the other simple methods mentioned

5 **Sedation** In the post-operative period the patient must be kept as free from pain as possible and adequate dosages of morphine or of its derivatives must be given On recovery from the anaesthetic morphia gr ¼ is administered and this is given at necessary intervals in the next twenty four hours At the end of this period we prefer to change to heroin gr 1/12 injected four hourly although the tougher patient may require heavier dosage as some patients become nauseated by the continued injections of morphia On the third post operative day the injections can be reduced in number and by the fourth or fifth day if the patient is then taking fluids by mouth a barbiturate at night may be all that is required to ensure an adequate night s sleep

6 **Administration of Antibiotics** Streptomycin is given to all patients subjected to an excision with anastomosis during the few first post-operative days and in this period penicillin is also administered

7 **Disturbances of Micturition** Post operative difficulties of micturition are rare except in those resections in which mobilisation of the rectum has been carried out as part of the operative procedure In such cases temporary retention may occur probably the result of partial injury to the nerve supply of the bladder (Watson 1951) or in cases of abdomino perineal excision to the altered position of the bladder as a result of the removal of the structures posterior to it which in normal anatomy give it support (Innes Williams 1951) If a patient has failed to pass urine at the end of eighteen hours after the operation he should be catheterised under full aseptic conditions This period of eighteen hours should not be exceeded as if still further distension occurs and the muscle fibres of the bladder are allowed to overstretch normal urination is likely to be longer delayed At the end of a further twelve hours the patient is again catheterised if a normal flow has not been established and if after this there is still difficulty an indwelling Foley s catheter is inserted This is removed at the end of a week and thereafter it is seldom that further catheterisation is required It must not be forgotten however if difficulty or retention is prolonged that an enlargement of the prostate which in the ordinary individual may produce negligible symptoms can give rise to an obstruction in the patient upon whom the rectum has been removed The altered position of the bladder and the partial interruption of its nerve supply may be factors sufficient to convert an incipient into an actual obstruction In prolonged retention therefore transurethral prostatic resection may be necessary if cystoscopy has revealed enlargement of that organ

tapwater and is connected by rubber tubing and a glass connection to a rectal tube After this is lubricated the patient inserts its end into the colostomy for a distance of about 15 cm (6 inches) and he will quickly learn to do this with the gentlest of pressure He then controls the flow of fluid into the colon by pinching the catheter or by adjusting a screw clamp and allows the water to pass into the colon slowly On removing the tube fluid and faecal lumps will emerge from the colostomy being collected into a kidney dish The

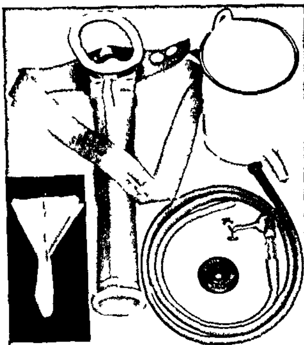


Fig 76

The apparatus employed for the daily colostomy wash out To the left is the finger stall employed for daily dilatation of the colostomy opening in the centre is the Nitch horn with the abdominal belt and drain age tube attached to the right is the container with rubber tubing and rectal catheter In the centre of the coiled tube is the perforated rubber disc to fit over the opening in the Nitch horn

colostomy will continue to discharge for a period of about half an hour or forty minutes and the patient will soon learn to appreciate when the action is complete

In the first few weeks of the care of the colostomy by this method irregular actions will continue but their number will quickly diminish until at the end of a month or so the only bowel action will be that induced by the morning washout Occasionally as a result of eating certain foods an attack of diarrhoea may result but the patient rapidly learns to avoid such food and drinks and they vary with the individual and with these exclusions from his diet he is able to control his colostomy action completely

11 **The Care of a Colostomy** If the patient has been left with a colostomy this may work slightly within a few hours of the operation before ileus becomes established Thereafter no flatus or faeces will be passed until peristalsis has returned to the abdomen by the end of which time it may start to act copiously of its own accord In those cases in which in spite of a return of peristaltic activity the colostomy has not functioned by the fifth post-operative day 125 cc (4 oz) of olive oil are run into it in the evening

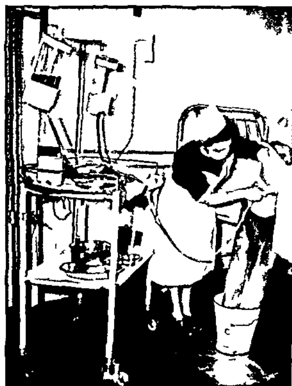


Fig 74



Fig 75

A close up view of the wound showing the introduction of the large bored rectal catheter used for the irrigation

Fig 74—The irrigation of the perineal wound of an abdomino perineal excision

and on the following morning a small washout of 200 cc (approx 6½ oz) of warm tapwater will usually produce an evacuation If this should fail an aperient is given

The patient is now commenced on his routine of daily morning washouts In the first week or so these are best carried out by a nurse with the patient lying on his bed but as soon as he is fully ambulant he is encouraged to perform these himself in the toilet

To commence it is wise to use the simplest apparatus and the Nitch horn to be referred to later is not given to the patient until he has fully mastered the technique of colostomy irrigations Above the seat of the toilet is suspended a 1 litre (or 2 pint) container at such a level that it lies about a foot above the patient s head when he is seated This is filled with warm

We have no doubt whatsoever that this method of care is infinitely preferable to the alternative of allowing the colostomy to establish its own routine of action If no washouts are given the colostomy will usually work in the morning and again in the evening but at uncertain times with the result that the patient s life is severely limited whereas by adopting the method indicated above the interference with his usual activities is minimal The continued irrigations do not give rise to a mucous colitis as is sometimes suggested (Gabriel 1948) and the danger of perforating the gut when the tube is inserted for the washout is eliminated by careful instruction of the patient The colostomy belt with which the patient is finally fitted is not designed to collect



FIG 79
A gauze cylinder filled with plasmon oats surrounding a transverse colostomy This device is sometimes used in the early stages of such a colostomy to prevent skin excoriation

faeces but serves as an abdominal support and to prevent abrasion of the delicate mucosa of the exposed bowel opening which is further protected by a small piece of tulle gras

In the first few weeks of the post-operative period a finger must be passed into the colostomy daily in order to prevent the inevitable contraction of the layers of the abdominal wall from gripping the emerging bowel too tightly with resulting stenosis This dilatation is unnecessary once the healing of the wound is complete

From time to time in spite of digital dilatation fibrosis occurs underneath the edges of the uniting skin and bowel mucosa so that the colostomy opening is gripped tightly by an encircling band of fibrous tissue Although it may

Before the patient is discharged he is provided with a colostomy wash out apparatus including the Miles modification of a Nitch horn which makes the washouts still easier (Fig 76) The latter consists of a plastic horn shaped receiver the broad upper open end of which is curved to fit over the colostomy The lower open end is connected to a long broad rubber tube through which the faeces are led to the lavatory pan Opposite to the opening fitting over the colostomy there is a hole in the horn over which fits a rubber diaphragm slit at its central point The apparatus is kept in position by a belt fixed round the patient s waist



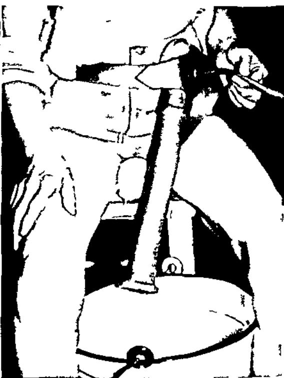


Fig 77 Fig 78

Fig 77—A patient carrying out her daily wash out Fig 78—A close up view of the Nitch horn in position showing the rectal catheter introduced through the perforated rubber disc

To wash out the colon the patient fixes the receiver and sitting on the lavatory pan with the broad tube running into it between his legs guides the rectal tube through the hole in the rubber diaphragm and thence on through the colostomy opening When the fluid has been run in the tube is withdrawn The escaping washout then pours into the horn and is conducted directly to the pan (Figs 77 78)

There is no doubt that with this apparatus washouts are freed of most of their messiness and with it patients are better able to travel and voyage where they will

started acting On the contrary some patients who have been habitually constipated long before the onset of their disease will remark that their bowels open more easily than ever before and without the aid of medicine

The drainage tube down to the site of the anastomosis is shortened on the third or fourth post-operative days and is removed entirely on the fifth If it is left in for this period of time a walled off track is formed leading down to the site of the anastomosis so that should any faecal leakage occur in the few days subsequent to its removal it will discharge along this route Although faecal leakage is uncommon and even when it does occur slight the surgeon need never feel alarmed if the anastomosis has been carried out in the manner suggested either that peritonitis will result or that the faecal discharge will be anything but transient It will cease within a few days and the patient s post-operative convalescence will be rarely interrupted

14 **Preparation of the Decompressed Bowel Prior to Resection** Five days before resection of the colon is planned washouts of the bowel are com menced These are given by the rectal route and through the artificial stoma both limbs of which are irrigated when a colostomy is present The irrigations are not as effective when carried out through a caecostomy as when given through a transverse colostomy in which case a completely clean and empty bowel will result but much of the impacted faecal matter behind a growth can be washed away by prolonged and patient caecostomy washouts At the end of each washout a solution containing a 5 per cent suspension of phthalyl sulphathiazole is run slowly into each limb of the bowel with a view to its retention by the patient About 120 cc (4 oz) of the solution can usually be retained In addition a similar solution is run into the colon distal to the growth through the rectal route The antibiotic effect of these instillations on the intestinal flora will augment the effect of aureomycin which is given in 250 mg doses four times a day for the three days immediately preceding the resection of the growth

15 **Pulmonary Complications** The incidence of chest complaints is reduced by pre-operative attention to dental sepsis and breathing exercises and by the pre-operative administration of antibiotics the latter being con tinued in the post-operative phase Immediate post-operative bronchoscopy whilst the patient is still anaesthetised on the operating table and the removal by suction of any mucopus that has collected in the bronchioles during the operation is of the greatest value in preventing chest complications in those patients who are suffering from chronic bronchitis

In the occasional patient who in the first few post-operative days is producing large amounts of purulent secretion and who is too weak to expec torate this as may occur in the old chronic bronchitic operated upon for an obstructive lesion an endotracheal tube should be passed through the nasal route Through this a fine catheter connected to a suction machine is then introduced and the pus accumulated in the trachea is removed The introduc tion of the endotracheal tube in the conscious patient requires some skill and

be possible to pass a rectal tube through the site of the stenosis colostomy washouts are never satisfactory as the faeces are not readily expelled through the obstruction As a result complete emptying of the colon is not achieved and the colostomy will act at irregular intervals throughout the day

In such cases the line of union of mucosa and skin and the underlying fibrous ring must be excised and the two edges accurately sutured again We have not had a patient in whom following this excision which is carried out under general anaesthesia stenosis has recurred

Where a temporary transverse colostomy has been instituted the early evacuations from this are often semi fluid and these sometimes give rise to excoriation of the skin This is best prevented by applying aluminium paint to the skin and surrounding the colostomy with a tubular gauze bag filled with oatmeal (Fig 79) This absorbs much of the proteolytic ferments present in the faeces and thus helps in the prevention of autodigestion of the skin

12 **Care of a Caecostomy** In the post-operative care of a caecostomy the chief difficulty is to prevent the severe excoriation of the skin which is so prone to develop The Paul s tube tied in at the time of operation is likely to loosen in about four days and before leakage around the region of its insertion into the caecum develops it should be removed A disposable ileo stomy bag is then affixed to the skin around the caecostomy and this will require changing every day In spite of the presence of the bag a certain amount of contamination of the skin with resultant superficial ulceration sometimes occurs and where this has developed the bag will no longer adhere to the skin It is best then to use the methods suggested above and to collect the faeces as far as possible by one of the old type ileostomy bags maintained in position by an elastic belt The skin around a caecostomy as that around an ileostomy develops in time an immunity to the intestinal secretions and when the acute inflammation and excoriation have settled the disposable bag should be re applied

In both a caecostomy and a transverse colostomy the rather fluid stool is made more solid and therefore more controllable by giving the patient one or more of the water absorbing substances such as edifas collagel or isogel Pro banthine may help by diminishing the activity of the bowel

13 **Especial Points Concerning the Care of Resected Cases with Restored Continuity** Many of the patients upon whom a resection with anastomosis has been performed have a normal bowel action when peristalsis returns in four or five days If this action is delayed for more than twenty four hours after this return a mild aperient such as a tablespoon of paraffin and milk of magnesia emulsion is given and seldom is a more drastic purgative required Enemata must never be given as the fluid may easily be irrigated through the line of suture or the tube itself may cause its injury It may be necessary to continue with an aperient but as a large length of bowel has been removed and the absorption of water from the stool is correspondingly diminished most of these patients have no difficulty with their bowels once they have

Where commencing thrombosis is diagnosed a sample of blood is removed in order to estimate the prothrombin concentration and an intravenous injection of 7 500 units of heparin is then administered This dosage is repeated at four hourly intervals for the next forty-eight hours After the first injection the patient is given an initial dose of 600 mg of tromexan by mouth followed by six hourly doses of 300 mg At the end of the twenty four hour period the prothrombin concentration must be estimated again and the estimations must be continued at similar intervals throughout the period during which the patient is under treatment The aim of anticoagulant therapy is to reduce the prothrombin level to between 10 per cent and 20 per cent of its normal value and whilst high doses of tromexan may be necessary for about three days once the lowered prothrombin value has been achieved maintenance doses of about 300 mg daily are then all that are required It is essential that the repeated estimations of the prothrombin are carried out as the response of each individual to tromexan varies and if excessive doses are given the danger of haemorrhage is a very real one On the contrary other patients develop a rapid tolerance to the drug so that the maintenance will require increasing The method of administration is well described by Hougie (1951) and a close liaison between pathologist and surgeon must exist when this complication is under treatment

The only patient who developed a thrombosis in our series of operations for carcinoma of the colon of the type described was the case referred to above Since the introduction of tromexan as opposed to dicoumarol which in spite of careful control carried with its use the danger of severe or even fatal haemorrhage we have not found it necessary to resort to ligation of the femoral vein in dealing with cases of thrombosis occurring in other branches of our practice It would seem therefore that reliance can be placed on anticoagulent therapy should the complication arise as a result of operative procedures on the colon

17 **Intestinal Obstruction** Complications due to this cause are minimised by covering the raw areas left at the completion of an excision with peritoneum wherever possible so that band and adhesion formation are unlikely Where an abdomino perineal excision has been performed suture of the emerging colostomy to the peritoneum covering the lateral wall of the pelvis will prevent loops of small intestine insinuating themselves between the two structures with the possibility of becoming obstructed there In the same operation the re formed peritoneal floor should be so sutured that raw edges are directed away from the peritoneal cavity thus eliminating the formations of adhesions at this site Before finally closing the abdomen this floor must be carefully inspected to make certain that there are no small tears or holes present through which in the immediate post-operative period a small knuckle of gut could protrude Finally in cases of resection with anastomosis the colon must be sutured to the posterior abdominal wall to prevent the small intestine passing behind it and thus becoming obstructed Nevertheless in spite of all technical

is best performed by the anaesthetist practised in this art As the tube passes through the cord violent coughing helps in the expulsion of the retained mucopus The improvement in such a patient following this treatment is marked The distressed breathing the constant endeavour to expectorate the pus that he himself has not the strength to cough up the associated cyanosis and the restlessness are relieved and in severe cases we consider that it is life saving If there is a recurrence of the accumulation of secretions in the lung the procedure must be repeated When in spite of these precautions broncho pneumonia develops sulphamerazine in addition to the antibiotics should be given the initial dose being 3 g followed by 1 g at six hourly intervals

16 **Thrombosis** The preliminary build up of the patient in the pre operative period is partly designed to diminish the possibility of post operative thrombosis and the danger of pulmonary embolus The value of careful positioning of the patient on the operating table so that pressure on the popliteal veins is avoided has been referred to in Chapter VII Meticulous attention to operative technique with the avoidance of unnecessary trauma and the prevention of faecal contamination of exposed retroperitoneal tissues will also diminish the incidence of this complication In the post-operative phase early mobilisation with massage and breathing exercises and the replace ment of any blood lost during the operation or on return to the ward are other factors that help in its prevention Yet in spite of these precautions femoral thrombosis occasionally occurs An unexplained rise in temperature may be the first indication of its development and this may be associated with the complaint of aching pain in the calves In the majority of cases however no pain is complained of and a rise in the temperature may be impossible to distinguish from that due to a chest urinary or other complica tion The most constant early sign is the presence of pain when pressure is exerted by the clinician over the courses of the posterior tibial or peroneal vessels for as Murley (1950) has shown conclusively it is in the tributaries of these veins that thrombosis starts It is therefore necessary for the clinician to carry out a daily examination of the legs of all patients upon whom these operations have been performed so that where possible an early diagnosis of this dangerous complication can be made

In spite of the most careful daily examination however an overwhelming fatal pulmonary embolus will occasionally occur On the morning prior to the day of discharge of one of our cases whose recovery from a resection with anastomosis had been uneventful the complete absence of any of the signs of tenderness along the peroneal or posterior tibial veins was demonstrated by the author to his students Yet four hours later the patient suddenly collapsed whilst walking in the ward and died almost immediately of a massive pulmonary embolus Nevertheless the early recognition of the signs present in the majority of patients who develop thrombosis and the immediate commencement of treatment in such cases will reduce the fatality rate of this condition markedly

of the obstructed loop of gut the possibility of the presence of a strangulation must ever be present in the clinician's mind At the initial examination of the patient any definite area of severe tenderness or rigidity in the abdomen may suggest this possibility and if the diagnosis is uncertain a periodic check on the patient's condition must be made every few hours after the setting up of the stomach suction and intravenous glucose saline therapy In the case of



FIG 80
A Miller Abbott tube passing well down into dilated coils of small intestine

a simple obstruction the patient's general condition will soon improve with this treatment Where strangulation is present this improvement is not noted and instead deterioration with increased rapidity of the pulse rate and more marked abdominal tenderness and rigidity becomes evident Auscultation of the abdomen is also of value in the differential diagnosis between the two types of obstruction as in those cases where the blood supply to the bowel is interrupted the accentuated sounds of simple obstruction soon diminish and as a localised peritonitis develops they disappear As soon as obstruction with strangulation is diagnosed the treatment is immediate laparotomy in order to release the blood supply to the affected region of the bowel before irreparable damage necessitating a resection has been done

perfection designed to prevent the causes of obstruction this complication will occasionally occur at various stages in the post-operative phase

The abdominal distension and vomiting accompanying the condition must of course be differentiated from that due to ileus but in the former colicy pain is usually present If peristalsis is visible through the anterior abdominal wall it is quite obvious that the symptoms are those of true obstruction In any case of doubt auscultation of the abdomen must be carried out for the increased sounds accompanying this condition will readily differentiate it from a paralytic ileus So long as the surgeon is certain that the obstruction is simple and that strangulation is absent the complication should be treated conservatively in the initial stages and most cases will settle An intravenous glucose saline drip is set up and gastric suction through a Ryles tube commenced Abdominal distension will usually rapidly subside but if it continues and the aspirations drawn up through the Ryles tube are small in quantity the tube is removed and is replaced by a Miller Abbott tube This is passed into the stomach as far as the 75 cm mark and the patient is then rolled on to his right side and left in this position whilst suction is commenced The positioning of the patient encourages the bulb of the tube to fall towards the duodenum by the effect of gravity An X ray at the end of this period is taken to ensure that the tube is in this position and is not lying coiled in the stomach Should this latter difficulty have occurred the tube is withdrawn and the manoeuvre is recommenced As soon as the X ray film confirms the position of the end of the tube as being in the duodenum the balloon at its end is inflated with 20 cc of air The distension of the bowel produced in this way stimulates peristalsis and therefore the onward passage of the tube through the coils of intestine towards the site of the obstruction and the constant suction maintained at the various levels of its descent empties the bowel of its accumulated fluids Periodic X rays are necessary to check the position of the end of the tube (Fig 80)

A careful fluid balance chart is maintained during this treatment and the intravenous fluid is given in volumes sufficient to replace the total withdrawn in the aspirations plus that passed in the urine and that lost to the body through the lungs and through the skin This latter loss is probably about 1 500 cc in the twenty four hours As in the treatment of ileus periodic estimations of the plasma chlorides are carried out in addition to the routine examination of every specimen of urine for the presence of this salt Early replacement of excessive loss can then be rapidly overcome by changing the glucose saline drip to one of normal saline The serum potassium must also be estimated daily and deficiencies corrected as previously described

The abdominal distension will usually rapidly subside by these methods and during the treatment the patient may be given sips of fluid by mouth If these are not absorbed they will be rapidly withdrawn in the aspirations

Although most obstructions following these operative procedures are of a simple type and not associated with any occlusion of the vascular supply

CHAPTER X

BENIGN TUMOURS OF THE COLON

CONNECTIVE TISSUE TUMOURS

APART from those arising from the epithelium benign tumours of the colon are rare Glenn (1939) for example reported that with the exception of the case that he recorded there was no other proven case of neurofibroma of the large bowel Myomata are similarly seldom encountered and Hunt (1921) who added four cases to the literature stated that only twenty cases had been described prior to his report A further case was reported by Fried and Stone in 1930

Lipomata of the colon though still rare are more frequently described Pemberton and McCormack in 1937 collected reports of 116 cases and Gault and Kaplan in 1941 noted that including their own a further thirteen had been added to the literature More recently a series of cases has been described by Bigelow and Anlyan (1949) and Mayo and Greiss (1949) have reported upon a comparatively large number of nineteen

It is therefore obvious that few surgeons will have a wide experience of these conditions and it is likely that should one present a diagnosis of carcinoma may well be made The symptoms to which these tumours give rise simulate those of cancer closely Disturbances of bowel habit bleeding from the ulcerated surface of a tumour projecting into the lumen of the colon colicy abdominal pain or the acute pain associated with the formation of an intussusception of which the growth is the apex are all the symptoms of cancer and the conditions may be indistinguishable Occasionally the surgeon may consider the possibility of an innocent tumour where the complaints have been present for many months or even years without any associated decline in the general condition of the patient and a barium enema may help to suggest the diagnosis if the filling defect is smooth and round and unlike the irregular protrusion or stricture formation of a cancer Exploratory laparotomy will be necessary in all such patients and it is often only at operation that the diagnosis becomes apparent The softness of the tumour its smooth surface and rounded edges and the absence of any infiltration into the bowel wall are all signs that will suggest the benign nature of the mass

In some cases the tumour is confined to the wall of the colon but in others it may project into the lumen attached only by a narrow pedicle to the mucosal and submucosal tissues or it may extend outwards so that a very obvious subperitoneal swelling is present Sometimes when the tumour is pedunculated it is difficult to find and careful palpation of the colon is required in order to identify it The surgeon will have little difficulty in recognising that he is dealing with a connective tissue tumour of a benign type and excision of the growth by colotomy or by removal of a small segment of the

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red blood and felt faint On examination the patient looked pale but apart from altered blood on the gloved finger passed into the rectum no other abnormality was discovered on physical examination Haemoglobin on admission was 63 per cent The patient was given blood transfusions and the melaena subsided over the next two days After suitable preparation the patient was sigmoidoscoped and at 13 cm from the anal margin a small swelling protruding from the mucous surface with its summit covered by blood clot was seen No enlarged blood vessels were observed underneath the mucosa A biopsy of the tumour was taken and was accompanied by brisk haemorrhage This was controlled by diathermy which was used to coagulate the rest of the tumour The biopsy report showed angiomatous tissue Subsequent barium enema and barium meal and follow through examinations showed no abnormality The patient has remained symptom free and a repeat sigmoidoscopy showed residual scarring at the site of the diathermy treatment only

In both of the cases recorded above the tumour was small and was treatable by relatively minor procedures The condition however may be so extensive that wide excisions of the colon and the other involved structures may be required for its cure as in the cases reported by Hunt in which an abdomino perineal excision of the rectum and pelvic colon combined with hysterectomy was undertaken for a tumour involving the large bowel and the uterus A similar extensive haemangioma involving the pelvic colon and the rectum was recently successfully removed by an abdomino perineal excision by Lloyd Davies (Fig 81)



FIG 81
An extensive haemangioma of the lower pelvic colon and rectum removed by abdomino perineal excision (Mr O V Lloyd Davies case)

Our experience in Case No 9 does suggest that in cases of severe and uncontrollable haemorrhage the formation of a colostomy proximal to the haemangioma by diverting the faecal stream and thus preventing its traumatic effect as it pours over the tumour may serve to stop severe and uncontrollable bleeding The removal of a portion of the tumour for biopsy purposes may in the first of the two cases have precipitated the severe haemorrhage although this did not occur until ninety six hours had elapsed but at the time of the

bowel containing the tumour with subsequent end to end anastomosis of the free ends of the colon is all that will be required for the cure of the condition

Haemangioma is another rare tumour of the large bowel and Hunt (1941) states that up to the time of his publication only twenty cases had been reported either at operation or autopsy The condition may be minor and consist of multiple small red nodules sited in the submucosa and linked with dilated arteries and veins but in other cases enormous cavernous haemangioma may infiltrate the whole of a portion of the colon extending to and involving adjacent structures According to Brown (1924) large submucosal angiomata may grow to such a size that in spite of the fact that they are easily compressed they may cause intestinal obstruction In our own two cases the tumours as seen at sigmoidoscopic examination appeared as small swellings the larger about 1 cm across In both the apices were ulcerated and covered with blood clot but sigmoidoscopy did not reveal the enlarged blood vessels present in the underlying submucosa The predominant symptoms of this condition haemorrhage from the anus which may be of the severest degree is well illustrated by these cases

Case 9 D E Male aged twenty one Attended in December 1951 complaining of bleeding per rectum He was a fit young man and a heavy weight boxer in the police force He had had no previous illnesses with the exception of childish complaints Two days prior to his attendance he noticed that on visiting the toilet he passed a quantity of darkish blood The desire to have his bowel opened was repeated seven times in the forty eight hours but with two exceptions blood only was passed On one occasion he estimated that he had lost about 1 pint There was no abdominal pain and he had no other symptoms The bowels had previously been opened regularly With the exception of dark blood on the glove of the examining finger passed into the rectum no other abnormality was found on examination

The patient was prepared for sigmoidoscopy at which examination a small sessile tumour about 1 cm across was seen at 15 cm from the anus It projected into the bowel lumen and apart from its summit which was ulcerated the mucosa covering it appeared normal A biopsy was taken Four days later by which time the specimen had been examined microscopically and was found to have an angiomatous structure the patient had a sudden and very severe haemorrhage from the effects of which he collapsed In spite of blood transfusions haemorrhage continued and at the end of forty eight hours it was decided that a left iliac colostomy should be carried out Soon after this was established bleeding ceased Seventeen days later the abdomen was re opened and the tumour was palpated in the pelvic colon The bowel was opened and the portion of the wall containing the tumour excised the colotomy wound being closed in two layers Recovery was uneventful and the colostomy was closed ten days later Subsequent barium enema examination revealed no abnormality of the large intestine and the patient has continued symptom free

Case 10 P T Male A soldier Aged nineteen Attended hospital in May 1952 He stated that he had been perfectly well until the previous day when he had a frequent desire to have his bowel opened and on each occasion passed dark blood On the morning of his admission he had had a severe haemorrhage of bright

conjunction with cancer of the colon and rectum and of thirty three cases both were present in twenty five a percentage of 75 as compared with a 10 per cent incidence of polypi found in colons and rectums examined at routine autopsies for deaths other than those due to colonic cancer

Polypoid tumours vary in size and may be single or multiple They may be sessile with a base as broad as the tumour itself and involving a large area of the circumference of the bowel wall such as occurs in the villous papilloma





FIG 83 FIG 84

FIG 83—A large villous papilloma of the colon The fronds of the tumour obscure the portion of the wall of the bowel from which it arose and which was excised together with the papilloma FIG 84—A pedunculated adenomatous polyp

(Fig 83) or they may be attached by a strap like delicate band of fibrous tissue covered with epithelial cells and containing the blood supply to the actual polyp which suspends it from the mucosal lining like a berry from a stalk (Fig 84) They occur at all ages though they are commonly found after the age of forty and the great majority are localised to the sigmoid colon and upper rectum

Symptoms and Diagnosis The symptoms to which they give rise are normally those of bleeding although in the early stages of their development when small in size their presence is not accompanied by any abnormality The bleeding is not usually severe and may be bright red in colour though if the adenoma is sited well up in the pelvic colon or above this level bleeding is often followed by the passage of dark blood which is smeared round

examination it was not appreciated that the tumour was an angioma In the second case the possibility that the swelling was of this nature was appreciated as a result of our very recent experience but because of its small size it was considered that any bleeding immediately following the biopsy could be con trolled adequately by diathermy coagulation which treatment would also serve to cure the lesion

CARCINOID TUMOURS

Argentaffin tumours occasionally occur in the colon taking origin from the Kultschitzky cells which although mainly confined to the small intestine are also found in the large bowel (Ash worth and Wallace 1941) These tumours give rise to constricting lesions of the colon indistinguishable from a carcinoma and in view of the fact that in many cases the innocency of such is open to extreme doubt and that in some metastases may even be present in the lymph nodes draining the involved area it is right that they should be treated by similar methods



Fig 82
Part of a pelvic colon in which numer ous polypi are present Two of these show obvious malignant degeneration and similar changes were revealed on micro scopic examination in other of the adenomata

INTESTINAL POLYPI

Benign polypoid tumours of the colon are as common as those of connective tissue origin are rare and they present a problem to the surgeon particularly because of their tendency to undergo malignant change Klem perer (1938) found that of ninety nine polypi either biopsied or excised fourteen showed microscopic evidence of cancerous change and Castro Garnet and Smith (1951) noted a similar incidence of such degeneration amongst the 352 specimens they exam ined Further suggestive evidence that some cancers of the colon have their origin in benign adenomata is the frequency with which the two are associated (Fig 82) and in a series where such association existed Klemperer noted that in 22 7 per cent of the 79 cases microscopic examination revealed that the mucosa of the apparently benign polypi was starting to develop the characteristics of cancer cells Dukes (1926) too emphasised the very common finding of adenomata in

It is the natural desire of all to avoid this whenever possible and they consider that provided the closest follow up is maintained should a local recurrence occur it will be recognised at a stage in the disease sufficiently early to allow of its removal by radical excision before the condition has spread beyond the areas removed by such an operation

Whilst we are in complete agreement with their treatment of rectal polypi we consider that in all cases occurring in the pelvi rectal junction or above if the pathological examination of a locally excised polyp shows frank malig nant changes the modified radical excision of the pelvic colon should be undertaken unless the age of the patient and his general condition precludes major surgery Sufficient evidence is not as yet available to enable the surgeon to be absolutely certain that by local excision the disease can be eradicated and as a resection of the colon can be carried out with negligible risk with out an associated colostomy and without any post-operative morbidity we consider that this form of treatment is to be advised whenever examination of the tumour has shown that malignant change has supervened Such an approach to the condition is in keeping with the opinions expressed by Demuth Cherney and Fitts (1952) and is in accord with the experience of McLanahan Grove and Kieffer (1949) Moreover the common multiplicity of colonic adenomata suggests that changes are occurring in a considerable area of the bowel mucosa and where malignancy has developed in one region the possi bility of its origin in adjacent zones is a very real one These regions will be removed by the modified radical excision suggested as the most rational form of treatment for the disease

In order to assess whether cancerous change has taken place in a polyp it is necessary that the whole of the growth should be available for examination by the pathologist whenever possible It is impossible for him to be asked to express an opinion on the adenoma as a whole if all that is available for section is a small biopsied area of the tumour as the region that has started on its course of malignant degeneration may well not be included in the portion available for examination If feasible therefore the tumour should be removed *in toto* if an adequate examination is to be achieved Moreover its cellular structure must not be destroyed by excessive electro-coagulation in the course of its removal

When the excision of the tumour *in toto* is not feasible multiple biopsies must be taken from different sites of the adenoma so that all areas of the tumour may be examined histologically The removal of multiple fragments for examination from numerous and different parts of the adenoma will reduce any error of the interpretation of the nature of the tumour to an absolute minimum Should malignant changes be identified then the modified radical excision of the pelvic colon must be carried out and local removal by diathermy by colotomy or by excision of a small length of the colon must not be relied upon Involvement of the lymphatic glands with cancer may have already taken place and with the latter procedures they will remain to give rise to recurrence of the disease at an early date

the surface of the stool A damp discharge from the anal orifice the result of excess mucous discharge from the mucosal surface of the polyp may also be complained of Alteration of bowel habit is very uncommon except in those cases where many polypi are present when diarrhoea may result Cattell and Swinton (1940) record a case in which obstructive symptoms had developed the result of the size of the polyp In other patients the polyp may prolapse on defaecation or forming the apex of an intussusception appear at the anal orifice in this manner Many of the smaller polypi however will only be diagnosed as a result of sigmoidoscopic examination for complaints not related to the presence of the adenomata

Barium enema examination and sigmoidoscopy must of course be carried out in all cases in which the symptoms point to a lesion in the colon though the identification of a small mobile polyp by the former method is by no means certain In those cases in which sigmoidoscopy too fails to reveal the presence of a polyp in a patient the symptoms of whom suggest its presence the X ray examination must be carried out again at the end of two months in a further endeavour to localise the lesion

Treatment Pathological examination of excised polypi removed at operation or autopsy shows in different cases various stages of change between a mucosa that is absolutely benign and one in which frank malignant degeneration has supervened and invasion of the stalk of the adenoma has taken place The degree of changes that can occur are well divided into six phases by Lockhart Mummery (1952) and by Lockhart Mummery and Dukes (1952) In the first stage the mucosal cells covering the polyp are normal and in the second active proliferation in certain areas gives rise to regions where the staining of the cells is more intense In the third stage referred to as carcinoma *in situ* the proliferation of the cells has probably transgressed the bounds of innocency but invasion of the submucosal tissues has not yet taken place These authors agreed as a result of their study of the follow up results that in such cases local excision is sufficient for the cure of the condition

In the last three stages there is no doubt of the cancerous change and they are divided into those in which the growth has transgressed the mucosal layer but slightly those in which the stalk of the polypus has started to become involved and finally the case in which the carcinomatous invasion has extended into the wall of the bowel Of these latter three groups radical surgery is advised in all cases where the histological examination reveals a high degree of malignancy in the cancer cells or in those in which the cancer has extended through the stalk to involve the bowel wall or to be in close proximity to it Those in which a low grade pathological grading is found and in which the cancer is confined to the polyp they consider adequately treated by local excision

It must be noted that the writers are considering the treatment of rectal polypi and that the alternative of a more radical excision involves the abdomino perineal operation with the establishment of a permanent colostomy

On the basis of these considerations the plan of treatment adopted in dealing with colonic adenomata is as follows —

(1) The operating sigmoidoscope is introduced under general anaesthesia and rotated so that the tumour projects into the cut away end of the instrument In those cases where the adenoma is very small its removal by diathermy would so destroy its substance that accurate interpretation of its structure by the pathologist would be rendered impossible Such tumours are therefore removed by punch biopsy and the bases are then diathermied

(2) When the adenoma is large and attached by a broad base or suspended by a stalk from the wall of the bowel it is surrounded by a snare and severed by a slow cutting current the base being subsequently diathermied Little destruction of the structure of the adenoma will result from this method of removal

(3) If the tumour is of such a size that its whole extent will not protrude readily into the operative field at the end of the sigmoidoscope it is advisable to remove it on a future occasion if innocent by open colotomy In order to obtain a guide as to the nature of the tumour however multiple biopsies should be undertaken by the electric snare for pathological examination If no evidence of malignant change is found colotomy can then be recommended with assurance that the condition can be cured by such a local excision If malignancy is present more radical excision must be undertaken

(4) Where the adenoma has been totally removed through the operating sigmoidoscope and the innocency of the tumour proved by pathological examination the patient should be sigmoidoscoped at six monthly intervals for the first few years not only to make quite certain that there has been no recurrence at the site of excision a contingency that is most remote but more particularly to ensure early recognition of any further polypi that may develop subsequently

(5) In cases where several adenomata are present the same principles of treatment apply but where they are very numerous or the condition is one of acquired multiple polyposis resection of the affected area will certainly be required and in the worst cases where the disease is widespread throughout the colon and the rectum total removal of these regions along the lines suggested in Chapter XI must be considered

(6) Where the tumour is beyond the reach of the sigmoidoscope it must be removed by colotomy or by local resection of the bowel with immediate restoration of continuity A frozen section of the adenoma should be carried out so that if malignant changes are identified the local can be converted into a radical operation Figure 86 illustrates a large benign polyp of the caecum excised by local resection of the bowel as a frozen section at the time of operation had proved its innocency

Local Excision of Benign Tumours by Colotomy Pre-operative preparation of the bowel must be as thorough for this operation as for an extensive

In dealing with these tumours an operating sigmoidoscope is required and the author s pattern (Fig 85) described originally in 1939 and since modified by Down Bros has certain advantages

The tube of this instrument is made of opaque non conducting material and is 1 in in diameter From the distal 2 in a third of its wall is cut away to form a slot Along the tube on the side away from the slot runs an insulated lamp and suction tube and the position of these may be adjusted by sliding them backwards or forward on the rail fitted to the proximal end of the sigmoidoscope

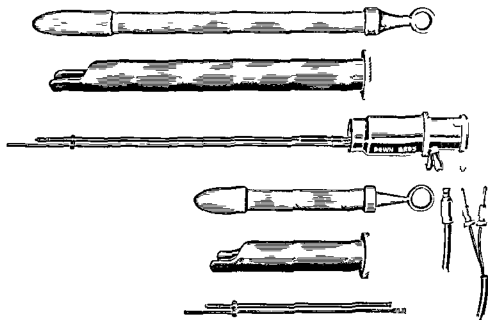


Fig 85
The author s diathermy sigmoidoscope

Before the introduction of the instrument the lamp and suction tube are removed and it is fitted with its obturator When introduced the latter is removed and with an eyepiece fitted with a light and bellows in position it is passed up towards the tumour in the normal way The instrument is then manipulated so that the tumour projects into the slot With the escape of air that takes place on removal of the eyepiece the projection of the adenoma into the slot of the sigmoidoscope is still more marked making its subsequent removal with a diathermy snare a simple matter The suction tube and insulated lamp are then placed on the runner and adjusted into position opposite the tumour The presence of a suction tube connected to a suitable apparatus immediately opposite the site of electro-coagulation or diathermy excision of the adenoma is invaluable as the field of operation is unobscured by smoke and complete visualisation is maintained throughout the instrumentation

placed endometrium is difficult to account for and Sampson s (1924) view that it is derived from a backward regurgitation of menstrual blood up the fallopian tubes with subsequent growth of contained fragments on the peritoneal surface of the pelvic viscera does not explain those cases which occur outside the peritoneum

Meyer in 1919 and Novak in 1926 suggested that because of the common origin of the peritoneum and the genitalia from the primitive coelomic epithelium these various structures all possessed under certain influences the power of producing endometrial tissue but again extra peritoneal cases of the disease remain unexplained It is possible that there is more than one cause of the condition and that in certain instances Halban s (1924) theory of lymphatic dissemination may be a correct one

Ectopic endometrial tissue is occasionally found in the wall of the bowel without apparent involvement of other structures in the pelvis but as Counseller (1949) describes it is usually affected only when the pelvic endo metriosis is extensive The lesion in the sigmoid colon and upper rectum—that part of the large intestine most frequently affected—may consist only of a small nodule or it may extend to surround the whole circumference of the wall giving rise sometimes to the appearance of a stenosing carcinoma from which it may be impossible to differentiate it even at operation (Mayo and Miller 1940)

Symptoms The condition occurs most commonly in the fourth and fifth decades of life and amongst patients the fertility of whom is often subnormal In addition to the symptoms of a gynaecological type involvement of the colon may give rise to those referable to the bowel itself A change of bowel habit either towards constipation or towards diarrhoea rectal pain the discharge of blood or mucus abdominal or low back pain may all or severally be com plained of and such symptoms are usually worse at or may even be confined to the time of menstruation All patients with proven lesions of the recto sigmoid do not suffer symptoms referable to the bowel however and in Kelly and Schlademan s series (1949) only half had complaints identifiable with a lesion in this region In other cases the lumen of the colon may be so obliterated by the mass projecting into its lumen or by a stricturing form of the disease that sub acute or acute obstruction may develop

Diagnosis A prolonged history with the characteristic periodicity of the symptoms the general good health of the patient and associated gynaecological disorders may suggest a diagnosis

On sigmoidoscopy narrowing of the lumen of the bowel or the presence of a projecting mass usually with an intact overlying mucosa may on occasions be seen MacLean (1936) however has pointed out that the investigation is generally unhelpful Little aid is likewise to be gained from a barium enema

A certain diagnosis in this condition is rarely established pre-operatively and in Kelly and Schlademan s series it was made in only 14 5 per cent

resection of the colon and the details of this treatment have been recorded previously

In some cases of small tumours we have found difficulty in locating them at operation The softness of their texture the fact that a loose pedicle may give them free mobility their compressibility in the case of an angioma and the absolute normality of the bowel wall itself are factors that contribute to this inability to localise their position readily To overcome this in the case of tumours of the pelvic colon the patient is now sigmoidoscoped by an assistant before the abdomen is opened and the instrument is maintained in position with its end in contact with the tumour The exact site of the tumour is then determined accurately and the incision in the bowel wall can be made over the end of the sigmoidoscope the instrument being withdrawn before the mucosal layer is incised Non crushing clamps are then applied above and below the area of operation and the region is isolated with abdominal packs The incision in the colon must be made to one or other side of the base of the tumour and sigmoidoscopy will have revealed to which sector it is attached When the bowel is opened the extent of its attachment is readily seen and it is wise to include with the excised tumour a portion of the whole thickness of the bowel wall rather than to detach it from the mucosa only



FIG 86

A sessile benign polyp in the caecum The tumour was removed by local incision of the terminal ileum and the adjacent caecum The wall of the latter is turned back to expose the tumour

The deficiency left in the wall of the colon is sutured in layers the suture line being so placed that diminution of its lumen is reduced to a minimum Any adjacent appendices epiploicae are used to reinforce the line of closure

When the adenoma involves more than a third of the circumference of the bowel wall or where several large polypi are present close to each other it is best to excise the length of colon containing the tumours, restoration of continuity being achieved by immediate anastomosis In such cases it is unnecessary to excise more than a small wedge of the meso-colon and this is removed only because the subsequent approximation of the bowel ends is facilitated thereby Drainage down to the site of the suture line is essential in both of these operations

ENDOMETRIOSIS

Endometriosis is a condition in which tissue identical to that of the lining of the uterus is located outside this organ The origin of this abnormally

CHAPTER XI

FAMILIAL INTESTINAL POLYPOSIS

FAMILIAL intestinal polyposis is a rare hereditary condition in which multiple adenomata are found throughout the rectum and the colon (Fig 87) The surgical interest in the disease lies in the fact as Dukes (1936) has emphasised, that malignant degeneration of one or more of these polypi is almost certain at some stage in the patient s life subsequent to their development Lockhart Mummery in 1925 reported a series of three families whose members were afflicted by the condition and drew attention to the high incidence of cancer of the colon and rectum in their family trees He also pointed out the relatively early age at which malignancy occurred and Dukes (1952A) analysing 156 cases of polyposis amongst whom 115 had developed cancer found that the average age at the time of the diagnosis of cancerous change was only thirty five years The same author (1952B) notes that the average age of those who died of cancer supervening on top of familial polyposis was just over forty-one years compared with sixty-eight the average age of death of those dying from cancer of the rectum amongst the general population of England and Wales These figures emphasise the fatal nature of the disease and justify the most extensive surgery as the only possible means of its cure



FIG 87
Multiple polyposis of the colon

The disease is transmitted by affected males and females equally and both sexes are similarly liable to the condition It is considered by Lockhart Mummery and Dukes (1939) to be the result of a gene mutation and is inherited as a dominant Mendelian character Of the children of parents one of whom suffers from this disease half are therefore likely to develop the condition

The occasional case of multiple polyposis presents in which it appears that no other member of the family is affected It is of course possible in such cases that the disease has escaped diagnosis in preceding generations or that it has

11A

Treatment In the obstructed case a colostomy must first be instituted followed by resection of the involved region of the colon It is probably best in such extensive cases to accompany this by removal of the ovaries In other patients particularly in women of a younger age group Heineberg (1926) advises subcastrating doses of X rays which may be effective in alleviating the symptoms without introducing all the psychological disorders associated with an early menopause In the older patient castration by irradiation or operation is probably best

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change is to extirpate the affected area of the bowel whilst retaining rectal continence This is usually achieved by carrying out a subtotal colectomy associated with an anastomosis effected between the terminal ileum and the pelvi rectal region Adenomata in the rectum are then destroyed by electric coagulation either in one or several sessions according to the extent and number of the polypi At regular intervals subsequently a sigmoidoscopy of the remaining segment of the large bowel is carried out and new polypi that have developed or recurrences amongst those previously dealt with are subjected to further diathermy treatment The patient is completely continent following this operation although some frequency of bowel action is unavoidable as a result of the removal of the larger part of the colon

The disadvantage of this method of treatment is that the rectal mucosa that part of the lining of the large bowel most severely affected by the disease remains intact Even though it is kept under periodic and frequent review the danger that malignant change can supervene in overlooked adenomata or those that have formed in the intervals between the examinations is a very real one and such authors as Dye Olander and Monroe (1951) Guptill (1947) Ravitch and Sabiston (1947) and Goligher (1953) have reported cancer formation in rectums so treated Indeed in the severer cases of the disease the adenomatous formations are so numerous and so close to each other that the possibility of complete ablation by diathermy is open to doubt Other disadvantages of this treatment is the possibility of stricture formation supervening upon repeated diathermy treatments and even perforation of the bowel wall consequent upon excessive fulguration

In an endeavour to avoid these objections to this treatment Ravitch and Sabiston (1947) carried out animal experiments in which following a colectomy they stripped the mucosal lining of the remaining rectum and through the fibro muscular tube thus left pulled down the terminal ileum which had been severed close to the caecum and stitched it to the skin The animals developed satisfactory continence and the method was advocated for use in dealing with familial polyposis They reported a case so treated with a final good result

The technique of the operation is well described by Devine and Webb (1951) After suitable pre-operative preparation of the bowel the patient is placed on the operating table in the modified lithotomy position as used for the synchronous combined abdomino perineal excision of the rectum The surgeon working through the abdomen divides the terminal small intestine between clamps and after mobilisation of the pelvic colon and the upper rectum cuts across the latter at the pelvi rectal junction The distal cut end of the ileum and the proximal severed end of the lower part of the pelvic colon are brought out on to the surface of the abdomen so that the colon remains defunctioned and isolated

The sphincter is then stretched and the surgeon working at the perineal end injects a solution of novocaine and adrenaline into the submucosa thus

skipped one before manifesting itself again in an age in which the clinician is more conversant with the condition and its recognition Moreover the multiple polyposis affecting the rectums and colons of such isolated cases is indistinguishable from that affecting the known familial type and the early development of cancer of the bowel is a similar feature of the disease Whilst admitting that the question is far from settled Dukes (1952A) believes that in view of the similarity of the two conditions the solitary and familial cases are likely to be one and the same disease

Symptoms These are few and do not arise until late childhood or early adult life when diarrhoea associated with the passage of mucus and blood draws attention to the condition Marked anaemia may accompany the persistent blood loss if the disease remains untreated with resulting ill health and lassitude until finally the symptoms of cancer of the colon or rectum manifest themselves

The members of those families in whom the disease is known to be present should be subjected to sigmoidoscopic examination at six monthly intervals so that in such cases the condition may well be recognised before any symptoms have been noticed by the patient

Investigation Following the general examination of the patient sigmoidoscopy is the first step in the investigation of any suspected case The condition affects most widely the pelvic colon and rectum so that if multiple polyps are present they are almost certain to be seen at this examination Sometimes the whole of the mucosa is so covered with polypi that it is difficult to pick out unaffected areas whereas in others a mere dozen or so may be seen The size of the adenomata differs the smallest being no bigger than millet seeds whilst the largest are a cm or more across Some are sessile and others attached by a delicate pedicle to the mucosal lining of the bowel

A barium enema is carried out This may reveal as multiple small filling defects the widespread nature of the disease extending beyond the limit of visualisation by the sigmoidoscopy The value of this investigation however lies mainly in the recognition of any early cancer that may have developed in the upper reaches of the colon as the presence of such a complication will require some modification of subsequent operative procedures

These investigations are carried out in the out patient department but where the presence of the disease has been confirmed a further sigmoidoscopy under general anaesthesia is undertaken with the operating sigmoidoscope At this examination several of the polypi in the rectum and colon are removed in their entirety especially those that are larger or are ulcerated or appear fixed as it is in these that malignant changes may have commenced It is upon the result of the pathological examination of these specimens that the final operative treatment will be planned

THE CHOICE OF OPERATION

The objective of surgical treatment in those cases in which preliminary investigations have shown that the disease has not yet undergone malignant

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necessarily subjected in order that the rectal mucosa can be visualised adequately for its dissection Devine and Webb make note of the fact that the anus was stretched to a diameter of three inches and following this excessive dilation the sphincter may not regain its normal tone

It is doubtful too whether the fibro muscular rectal wall with the exception of the ano rectal junction which contains the internal sphincter muscle complex and which is encircled by the pubo rectalis muscle serves any useful purpose It would seem better therefore to excise the whole of the rectum rather than to strip its mucosal covering alone and to anastomose the small intestine to the ano-rectal junction just above the encircling fibres of the pubo rectalis muscle and the internal sphincter The following operation was therefore planned and was carried out in a patient twenty six years of age suffering from the disease It was reported by the author in 1952 Fig 88 illustrates the widespread incidence of polyposis in the patient s family

ILEO ANORECTAL ANASTOMOSIS WITH EXCISION OF THE LARGE INTESTINE

First Stage Before operation the bowel is prepared by colonic irrigation and antibiotic or chemo therapy The abdomen is opened through a left paramedian incision and the terminal ileum is divided close to the ileo-caecal valve Both ends are closed The pelvic colon and rectum are now freed as in Miles s abdomino perineal excision De Martel s crushing clamps are then applied to the pelvi rectal junction and the bowel is severed between them The upper divided end is brought out through a stab incision in the left iliac fossa

The proximal end of the ileum is now mobilised so that it may reach to the bottom of the pelvic cavity with ease This mobilisation is achieved by division of the mesentery opposite the point at which the intestine has been cut across The intestine may be further elongated and straightened by dividing the vascular arcades supplying the last few centimetres of the bowel whilst still maintaining a very full blood supply

The mobilised ileum is now placed deep down in the pelvis to lie at the side of the rectal stump The peritoneal floor of the pelvis is then reformed as in Miles s operation except that in the present procedure the terminal ileum penetrates this newly formed pelvic diaphragm Here the edges of the peritoneum are sutured accurately to the wall of the small bowel following which the abdomen is closed The composite Figure 89 illustrates the above stages in the operation

The patient is then lifted on to his right side A curved skin incision is made extending from just behind the anus to the level of the sacro-coccygeal joint (Fig 90A) and the skin flap is dissected downwards The joint is opened and the coccyx separated from its anterior and lateral attachments is excised (Fig 90B) A finger is now passed above each levatores ani muscle the

11

raising the mucous membrane *from the underlying layer* The upper part of the rectal mucosa is similarly treated by the abdominal surgeon and the mucosa is then dissected away A rubber tube is then inserted through the anus into the abdominal cavity and the free end of the small intestine is passed over its upper end and maintained in position by a silk transfixion stitch On withdrawing the tube the small intestine is pulled down to the anus where

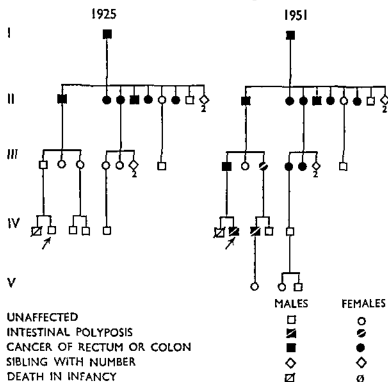


FIG 88
The family tree prepared by Dr C E Dukes of the patient indicated by the arrow referred to in the text The increase in numbers of those members of the family affected by the disease and by cancerous change is well shown by the com parison of the state of the family in 1925 and in 1951

it is sutured to the free edge of the muco-cutaneous skin of the anal canal left as a result of the removal of the rectal mucosa The upper end of the rectum is sutured to the wall of the small intestine as it passes into its cavity At a subsequent operation the isolated colon is removed

Devine and Webb (1951) reported two cases treated by this method and stated that they retained normal continence Goligher (1951) however described a further two patients in both of whom the reverse of complete continence resulted He attributed the failure of the operation to the fact that the anal stump contained insuffıcent mucosa to record that amount of rectal sensation upon which continence partly depends It seems more likely however *that incontinence following this operation results* from the damage suffered by the internal sphincter due to the extreme stretching to which it is

the pubo rectalis remains untouched and undamaged following which by end to side union it is anastomosed to the ileum (Fig 90D) A drain is passed down to the line of suture and the skin incision is closed

Before the patient is returned to the ward the long length of pelvic colon exteriorised on to the surface of the abdomen is removed and the resulting free end of the colon is sutured to the layers of the abdominal wall (Fig 91)

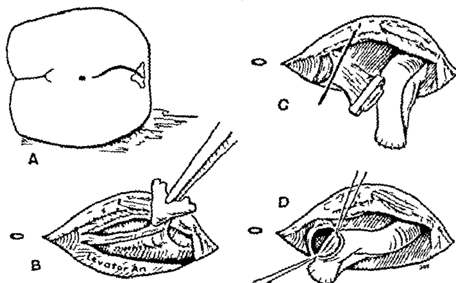


FIG 90

The perineal stages of the operation

(a) The skin incision
(b) Removal of the coccyx
(c) The terminal ileum and the rectal stump brought into the wound after division of the fascia of Waldeyer and the posterior portions of the levatores ani muscle
(d) End to-end anastomosis of the ano rectal stump to the ileum after the rectum has been cut across just above the pubo rectalis portion of the levatores ani muscle

Post operative Care The post-operative care to which the closest attention must be given follows that described in Chapter IX On account of the large amount of fluid that the patient looses when peristalsis returns and the intestinal content is evacuated in a semi liquid form glucose saline transfusions will require continuation for several days after the patient has commenced to take his feeds by mouth In this period too a potassium deficiency may well develop and until the post-operative overactivity of the intestine has subsided and the fluidity of the stool has been reduced by water absorbents such as Isogel or Edifas and by increased water absorption through the mucosa of the small intestine it is best to effect its replacement by the intravenous route

Slight faecal leakage may occur from the suture line in the perineum but by the time the second stage of the operation is undertaken some four to six weeks later the fistula will have closed

posterior two thirds of which are divided After division of the fascia of Waldeyer from its attachment to the last sacral segment the terminal ileum and the rectal segment can now be drawn into the perineal wound (Fig 90c) When the latter is gently pulled upon the fibres of the pubo rectalis portion

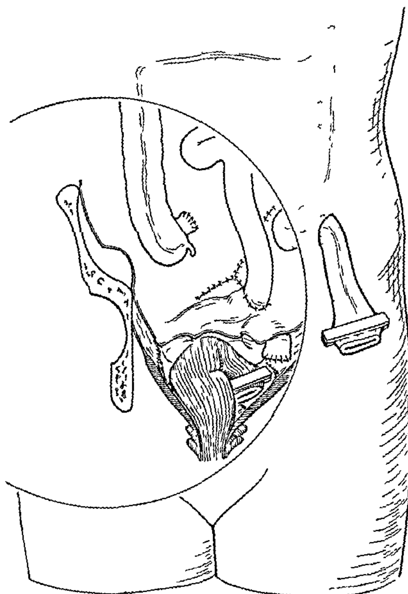


Fig 89

Composite diagram to show the abdominal stages of ileo ano rectal anastomosis The ileum has been divided and mobilised to lie in the pelvic cavity The peritoneum has been reformed around this and above the rectal stump The upper end of the rectum is exteriorised

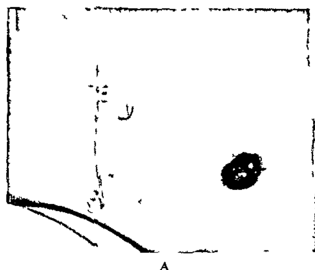
of the levatores ani muscle can be seen in the left extremity of the wound curving round the ano rectal junction in the form of a sling The rectum is severed just above this level so that the all important muscle of continence

No surgeon is likely to be called upon to operate upon many such cases but it is necessary for him to have a planned method of treatment in his armamentarium of operative procedures By the procedure described the whole of the affected bowel and its mucosa with the exception of a small rim of rectal mucous membrane at the ano rectal junction is excised and complete continence is retained The possibility of cancer developing in the remaining mucosa which is not more than 1 cm in depth is remote compared with the possibility that exists if the whole of the rectal or lower pelvic mucous membrane is left as in the operation anastomosing the ileum to the pelvi rectal region In future cases it might be a fairly simple matter to strip this band of mucosa and to suture in its place some of the mucosa of the ileum raised up for the purpose to avoid even this faint opportunity for polypi to recur and cancer to develop

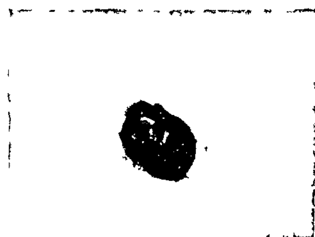
The patient upon whom this operation was carried out enjoys absolute continence and retains full sensation of when evacuation of the bowel is required In addition having experienced the urge to empty his bowel he can delay defaecation for over half an hour His bowels are opened eight to ten times in the twenty four hours including once between the time of going to bed at midnight and rising at 7 a m but these frequent actions inconvenience him but little He has suffered from no excoriation of the anal region neither have fistulae or fissures developed A year after the operation he weighed one stone more than he had ever weighed before

If during the preliminary investigations cancerous change has been shown to have developed in the rectum no attempt must be made to preserve this organ and with its removal by abdomino perineal excision and the excision of the rest of the colon the patient must be left with an ileostomy Where a cancer has formed in other parts of the colon continuity of the bowel can still be established by anastomosis of the ileum to the ano rectal region but during the subsequent colectomy that part of the colon affected must be removed with its area of lymphatic drainage The excision described in Chapter VII appropriate to the part of the colon involved must therefore be carried out in addition to the removal of the rest of the colon which can still be freed by cutting the meso-colon close to the bowel wall

Second Stage At this operation the abdomen is reopened through the incision previously employed and the colon is excised This is a relatively simple procedure as in view of the fact that the condition is as yet innocent no extensive excision of the region of lymphatic drainage need be undertaken It is sufficient therefore to liberate the colon by dividing its meso-colon close



A



B

FIG 91A and B

The colostomy at the end of the first stage of ileo ano rectal anastomosis The multiple polypi protruding from the end of the colon are seen

to the wall of the bowel The minimum raw area is thus left in the peritoneal covering of the posterior abdominal wall and needs no covering Separation of the colostomy from its adherence to the layers of the abdominal wall completes the liberation of the colon and the abdomen and the stab wound in the left iliac fossa are closed

CHAPTER XII

DIVERTICULOSIS OF THE LARGE INTESTINE AND ITS COMPLICATIONS

DIVERTICULOSIS

General Considerations Diverticulosis of the colon is a condition in which the mucosal lining has herniated through the muscular coats of the bowel at multiple points along its length The walls of these hernal protrusions are therefore thin and consist of mucosa and submucosal tissues only though occasionally an attenuated layer of muscle continuous with the muscular coat of the colon can be identified partially covering the diverticulum

The diverticula are of varying size as also are the orifices through which they communicate with the lumen of the bowel Sometimes the diverticulum is flask shaped communicating with the main intestinal passage by a narrow neck whereas in others the latter is almost as wide as the pouch like diverticulum itself the size of the orifices of many lie between these two extremes Microscopic examination shows that although the lining mucosa is of an intestinal type the cells are less columnar than those lining the colon When inflammation has supervened however hypertrophy may result In such cases oedema and later fibrosis is present particularly around the neck of the diverticulum so that the opening of the latter into the bowel becomes occluded

Many colons affected by multiple diverticula are the site of heavy deposits of subperitoneal fat although the muscular wall itself appears completely sound and not weakened by fatty infiltration This excess of fat serves to obscure the presence of the diverticula from superficial examination and in addition the swollen appendices epiploicae hide the saccules which they cover *intimately When freed from these coverings it will be noticed that the* diverticula lie as Mailer (1928) described in two roughly parallel rows one on either side of the bowel (Fig 92) and in close relation to the vessels supplying the wall of the colon Spriggs and Marxer (1925 1927) suggested that extrusions of mucosa were more likely to occur at points of weakness of the bowel wall such as were present where the blood vessels pierced the muscular layer of the gut Examination of the vascular supply of the colon and its relation to formed diverticula supports this view

At the mesenteric margin of the colon each small artery supplying the colon divides into two branches which then pass round the gut lying in the subperitoneal layer but superficial to the muscle coat This latter is pierced by these branches at its thinnest parts between the lateral taeniae and the

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with irregularities of peristalsis and regions of spasm which tend to force the mucosa through any weak area in the muscle Barling (1929) describes a patient who because of persistent abdominal pain was subjected to exploratory laparotomy At the time of the operation the sigmoid colon was observed to undergo irregular spasmodic contractions which resulted in the protrusion through the muscular coat of multiple minute pouches of mucosa These disappeared as soon as the spasm ceased but reappeared with each successive attack Barling was probably observing the genesis of a case of diverticulosis

Although diverticula may be found in any part of the colon from the caecum to the upper rectum it is in the pelvic colon that they are most frequent in number and incidence According to Smithwick (1942) in 75 per cent of cases the disease is localised to this region and only in just over 14 per cent is the condition widespread throughout the whole of the colon

The condition of diverticulosis is a widespread one over the age of forty Buie (1939) reported that 5 per cent of post mortems carried out on bodies over this age revealed the presence of diverticula whilst Morton (1946) gave a higher figure of 15 per cent occurring in 8 500 necropsies Cases occurring in childhood although rare have been reported [Ashurst (1908) Hartwell and Cecil (1910)] The sexes are probably equally affected although individual series of cases such as those of Mayo (1930) or Babington (1948) record differing sex incidence

Symptoms of Diverticulosis The symptoms of diverticulosis are often ill-defined and vague and in the series reported by Willard and Bockus (1936) they varied from chest pain to that of a duodenal ulcer More characteristic ally the patient complains of discomfort or pain in the lower left sector of the abdomen although occasionally the symptoms are referred to the middle or even to the right side probably the result of an excessively long loop of colon infringing into these areas of the peritoneal cavity Sometimes the pain is described as dragging and in one patient it may be constantly present from the time of waking to the time at which he falls asleep whereas in another it may be periodic in its occurrence The pain may not always be referred to the abdomen and may be sited in the loin or in the back and may even pass down the thigh

Some disturbance of bowel habit is common the patient normally complaining of increasing constipation although diarrhoea may be a presenting symptom This diarrhoea of which the patient complains is usually not a true flux and closer questioning will reveal that what the patient means by diarrhoea is an increased number of bowel actions in the twenty four hours although the consistency of the stool remains normal Occasionally mucus may be noticed in the stool We have had many patients in whom bleeding from the rectum has been the only symptom and as the fullest investigation has revealed no abnormality with the exception of multiple diverticula it must be accepted that the haemorrhage was due to this condition The bleeding may

longitudinal muscle lying along the mesenteric margin of the bowel (Fig 93) It is at these points of perforation that diverticula develop, and there can be no doubt that one factor in the aetiology of the condition is the existence of these



Fig 92

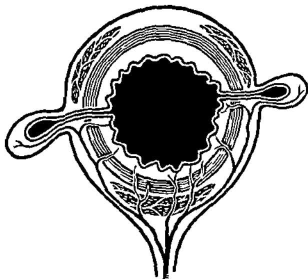


Fig 93

Fig 92—Multiple diverticula of the pelvic colon The colon a post mortem specimen has been divided longitudinally so that only one of the two parallel rows of diverticula is shown

Fig 93—Diagram to illustrate the relationship of the site of diverticula formation to the points at which the muscular coat of the wall of the bowel is perforated by the arterioles

potential points of weakness in the muscular covering of the bowel This is further proven as Edwards (1939) points out by the presence in advanced cases of diverticulosis of small saccules which penetrate the taenia mesenterica in the closest proximity to the small arteries entering the wall of the gut at this site These small arteries arise from the angle of the V formed by the division of each main artery supplying the colon and pass directly into the wall of the bowel perforating in so doing the taenia mesenterica This condensation of the longitudinal muscle is thus weakened by their presence The beautiful illustrations in Edward s work demonstrate the origins of diverticula at many points in the bowel through which the arteries are passing

Such points of weakness of the bowel as have been described exist throughout its length as well as in every colon not affected by the disease so that other factors must also be concerned in the production of these mucosal herniations The most probable explanation is that they develop in association



FIG 95A



FIG 95B

FIG 95A and B
Post evacuation barium enema X rays showing diffuse multiple diverticula of the colon

be moderately severe commencing with the passage of bright red blood which with the subsequent evacuations becomes increasingly darker and contains clots In one of these cases the loss of blood was such that blood transfusion was necessary



FIG 94

Barium enema X ray howing multiple diverticula in the recto sigmoid region The masses to which the diverticula had given rise were palpable through the rectal wall and the case was referred as one of carcinoma

Diagnosis of Diverticulosis Examination of such patients often reveals little that is abnormal and although the condition has been found more commonly in our experience in the obese those of normal weight are also affected In some the pelvic colon is far more readily palpable than in the average subject and a sense of discomfort may be experienced by the patient on pressure in this region

Rectal examination is usually normal but in the occasional case in which diverticula are present in the lower pelvic colon and in which faecoliths are present in the saccules a series of small discrete nodules may be palpable through the anterior rectal wall The presence of these nodules may give rise to the impression that the examiner is palpating a carcinoma of the pelvic colon but the fact that there is usually more than one separate swelling and that these are neither fixed nor indurated will suggest the true diagnosis Figure 94 shows the X ray from such a patient who had been referred to

and Bockus were likewise unable to account for the symptoms by the presence of these pouches in 50 per cent of their series

In overweight patients there is often marked improvement when they are placed upon a dietary regime of the type suggested in Table I combined with the administration of dexedrine and in suitable cases thyroid extract Physical exercises in those in whom the abdominal musculature has prematurely



FIG 96
Barium enema X ray showing a prediverticular state of part of the pelvic colon The outline of the bowel is ragged and the affected region does not distend normally

deteriorated is also of value We are not in favour of giving these patients a residue free diet as their improvement under treatment whether this is insisted upon or not seems the same and in those obese patients where an endeavour is being made to reduce the calorific value of the diet the cellulose containing food will be taken in larger quantities than customary

All patients must be given a course of colonic irrigations as a mechanical means of washing away the faecoliths contained in the diverticula for as long as these are present in the saccules which of themselves are quite incapable of expelling their contents the patient will always be in danger of an attack of diverticulitis and their removal by this form of treatment is essential To be effective the washouts must be thorough as in the cleaning of the bowel in cases of cancer and large volumes of fluids up to 23 litres (approx 40 pints) at each irrigating session are employed Each patient is given an initial

hospital as on examination for abdominal pain and constipation by her private doctor the rectal masses had been discovered and had been thought to be a carcinoma

The orifices of the diverticula are rarely seen on sigmoidoscopic examination Usually the appearances are those of a normal bowel although if bleeding is a symptom blood may be seen trickling down from the higher reaches of the colon Confirmation of the diagnosis made on a consideration of the symptoms and on the negative sigmoidoscopic examination can be obtained by a barium enema X ray (Fig 95A and B) The diverticula may be visualised when the bowel is filled with barium but they are often seen better following evacuation of the opaque medium and the distension of the colon with air The saccules then become inflated and the film of barium adherent to their linings renders many visible which otherwise would be obscured by a colon filled with a radio-opaque substance

If the X ray shows a normal colon and the clinician is still of the opinion that the diagnosis is that of diverticulosis it is wise to carry out a repeat examination for Wells (1949) has drawn attention to a series of films taken by Spriggs on the same patient in which the diverticula were absent in some and present in others These are X ray confirmations of Barling's observation at the operation referred to above that diverticula in their early stages are not static sacculations through the wall of the colon but that they appear or disappear in association with irregular contractions or relaxations of the gut

In 1925 Spriggs and Marxer drew attention to certain X ray appearances which they referred to as a pre diverticular state of the colon These appearances on barium enema examination consist of a ragged outline to the wall of the bowel which fails to dilate in the normal manner when the barium flows in In addition the normal segmentation of the colon is absent These findings were attributed by the authors to the presence of multiple minute herniations of the mucosa which had as yet not developed into full diverticula All radiologists do not agree that these findings are precursory to the development of full diverticula and Grout (1949) states that he does not like to diagnose the pre-diverticular state without the encouragement of at least one diverticulum Nevertheless these findings are often present in the barium enema of a patient whose symptoms could be attributed to diverticulosis (Fig 96)

The Treatment of Diverticulosis In a condition such as this the symptoms of which are not always well defined the clinician must beware of attributing the patient s complaints to the diverticula which may be revealed on barium enema examination and if doubt is present the possibility of the presence of other pathology must be considered and excluded Only then should treatment be confined to the diverticulosis Spriggs and Marxer (1925) analysing one hundred patients under investigation for abdominal complaints in whom X ray examination had revealed the presence of diverticula could not refer the symptoms to these findings in 29 of that number and Willard

so that inflammation the result of this cause is uncommon in these regions Nevertheless it does occur and the possibility that an obscure abdominal lesion above the level of the pelvic and descending colons is due to such a cause must be ever present in the clinician s mind

In its mildest form the inflammation may be confined to the neck of the sac so that the symptoms produced may be little more than those usually attributed to diverticulosis whereas at its most virulent early perforation of the diverticula into the general peritoneal cavity with resulting acute peritonitis may be the first indication of the change from a non inflammatory to an inflammatory condition Usually however reactionary adhesions and fibrosis will wall off the inflamed diverticulum so that the spread of infection is localised but in this process any of the abdominal contents in proximity to the colon may become involved so that the resulting symptoms may not be confined to the colon in which the pathological process commenced Thus adhesions binding down a loop of small intestine may give rise to the symptoms of a typical small bowel intestinal obstruction or a chronic abscess may perforate into the bladder with resulting urinary complaints

The following table represents a simple classification of the complications of diverticulitis which in addition to the original lesion are considered in the paragraphs which follow

TABLE II

1 Acute diverticulitis may progress to —
- *a* Perforation with general peritonitis
- *b* Perforation with pericolic abscess formation
- *c* Local non suppurative peritonitis
- *d* Metastatic suppuration
  - 1 Portal pyaemia
  - 2 Septicaemia
- *e* Fistulae as below

2 Sub acute diverticulitis may progress to —
- *a* Localised abscess formation with or without —
  - 1 Entero vesical fistula (vesico colic fistula)
  - 2 Entero vaginal fistula (vagino colic fistula)
  - 3 Entero cutaneous fistula
  - 4 Entero intestinal fistula
- *b* Large bowel obstruction
- *c* Small intestinal obstruction
  - 1 Acute
  - 2 Sub acute
- *d* Local non suppurative peritonitis
- *e* Metastatic suppuration

3 Chronic diverticulitis may progress to —
- *a* Large bowel obstruction
  - 1 Acute
  - 2 Sub acute
- *b* Fistulae of the above type

course of five daily irrigations and thereafter further washouts are advisabl- if there is any suggestion of a return of the symptoms

TABLE I

WEIGHT REDUCING DIET SUITABLE IN CASES OF DIVERTICULOSIS

Breakfast
Grapefruit boiled egg one thin slice of toast with a minimum of butter and marmalade Tea with a minimum of sugar or coffee with the same amount of milk that you would use if you were making tea

Mid morning
Tea or coffee as above only

Lunch
Vegetable (not potato) or meat extract soup steamed or boiled fish or an average portion of lean meat or game Avoid pork or duck or goose on account of their high fat content As much salad tomatoes or green vegetable as you wish One small potato only Avoid salad dressing but have vinegar and condiments as you wish
Instead of the meat or fish you may have an omelette or two lightly boiled eggs A small piece of toast may replace the potato For dessert have fresh fruit or salad

Tea
Cup of tea only

Dinner
As for lunch but in addition you may have two plain biscuits and a small portion of cheese with a pat of butter

Alcohol
Do not drink beer Gin and tonic or pink gin is the best

When the first series of irrigations is completed a course of guanimycin by mouth is commenced 30 cc (1 oz) being given twice daily on each of four successive days Although the condition of diverticulosis without any associated inflammation in the saccules may give rise to symptoms the possibility that localised inflammatory changes are present insufficient to produce any generalised reaction cannot be excluded It is therefore wise to give this course of intestinal chemotherapy As mentioned above except one of low calorific value in the obese patient we advise no special diet Liquid paraffin however is given as a routine as this by its lubricating quality aids the onward passage of the faeces through the affected region of the colon without portions of its mass becoming separated to embed themselves in the diverticula

DIVERTICULITIS

The continued presence of faecal material in the thinned saccules of the affected colon predisposes them to inflammatory changes as the mucosal lining is thin and readily ulcerated by the pressure of the hard faecoliths The highly infective bacteria in the faeces then have a ready portal of entry through which to pass It is the extent and degree of the resulting inflammation and their effect on adjacent structures that determine the many clinical complications associated with this condition

That these most commonly occur in the distal half of the colon and more especially in the sigmoid depends on the solid nature of the stool at these lower levels as well as the common incidence of diverticulosis in this region Where diverticula exist proximal to these sites the more fluid character of the stool makes it unlikely that impaction and retention in the saccules will occur

In the first few days of the infection colonic irrigations should not be employed as there is a real danger that until the condition has localised the flow of fluid into the bowel may break down any light adhesions that are forming over a site of incipient perforation and thus enter the general peritoneal cavity. Later, however, when an obvious mass is palpable in the left iliac fossa and the area is well localised and sealed off, irrigations are invaluable. They serve to clear the bowel of faeces that may be held up above the oedematous colon, the lumen of which is partially obliterated by the inflammatory process taking place in its wall, and to free the diverticula of their contained inspissated faecoliths. Response to this line of treatment is often quick and only a proportion of the cases will progress to any of the complications which will require operation.

THE COMPLICATIONS OF ACUTE DIVERTICULITIS

Perforation with General Peritonitis

This acute complication of the disease is rare as in the majority of cases which do not subside the infection tends to be walled off by limiting fibrous adhesions, so that should a perforation of the diverticulum result its effect is localised. When the condition has developed the signs are those of a typical acute peritonitis, although maximum tenderness over the colon in the region of the perforation may suggest its cause.

Treatment. In such cases urgent operation is required, although if the patient's condition is poor, preliminary transfusions of blood and glucose saline with stomach aspiration will be necessary. Streptomycin, if not already given, is administered at once and penicillin is also injected. At laparotomy the acutely inflamed bowel will be identified and the point of perforation, usually partially sealed off by omentum or other neighbouring structures, can be identified in most cases. Occasionally, although the whole of the affected region shows all the signs of acute inflammation, it is impossible to identify a point of perforation. It has probably been so minute that it has sealed off and in the generalised oedema and inflammation of the bowel remains hidden.

Where the perforation is so situated that, with or without mobilisation of the affected region of the colon, it can be brought to the surface, the loop of gut should be exteriorised, the perforation at its apex existing as a self established colostomy. In some cases the mesentery may be so shortened and thickened by oedema that full exteriorisation of the affected loop of the colon is impossible, but it is generally feasible to bring the perforated area to the skin surface to which it is accurately sutured. It is best to exteriorise the colon through a separate stab incision rather than through the main wound, as in the post-operative period the latter is then more easily protected by suitable dressings from faecal contamination.

Where the perforation is low down in the pelvic colon it is impossible to bring it on to the surface to form a colostomy. Every effort must then be made to close the hole in the colon as completely as possible, but this is made

ACUTE DIVERTICULITIS

Acute diverticulitis is sometimes a sudden incident occurring without any previous history suggestive of the diverticular state of the bowel although in other patients the predromal symptoms of diverticulosis suggest the diagnosis The inflammatory state is not confined to the diverticulum alone but spreads into the wall of the bowel so that a considerable length may be affected and if the patient is subjected to operation the red acutely inflamed oedematous colon with early fibrinous deposits tending to localise the infection is revealed

The illness starts with pain in the left iliac fossa accompanied sometimes by constitutional disturbances associated with a rise in the temperature and in the pulse rate There may be nausea and in the severer cases vomiting The bowels are usually constipated On abdominal examination extreme tenderness in the left and lower quadrant is present with guarding and rigidity and an ill-defined mass may be identified if deeper palpation is permitted by the patient

There is seldom any difficulty in the diagnosis in a typical case although an inflamed appendix passing well over beyond the midline may require differentiation The mid abdominal pain of a commencing appendicitis is absent in diverticulitis and in the latter condition the pain is confined to the line of the colon In diverticulitis occurring in the splenic flexure or upper descending colon the condition may be confused with acute inflammatory lesions of the kidney and an early perinephric abscess in which no abnormal ities of the urine are found may present a difficult differential diagnosis In such cases the tenderness is farther back than in a diverticulitis but the diagnosis may initially be doubtful

Where acute diverticulitis is present as a result of a lesion in the ascend ing colon or caecum the symptoms and signs so resemble appendicitis that a correct diagnosis before operation is unlikely to be made and in any case exploration will be required in such a patient

TREATMENT Before the introduction of chemotherapeutic methods many authors [Huston (1933) Delore (1932) Erdmann (1932) and Edwards] advo cated early operation in many of these cases There was a doubt as to whether the inflammatory process would subside and it was considered wiser to exteriorise the affected loop of colon and thus prevent the danger of peritonitis should the infection spread The inhibiting effect on coliform growth of such drugs as phthalylsulphathiazole streptomycin chloramphenicol and aureo mycin however has altered treatment radically and acute diverticulitis without developed complications is best treated conservatively Streptomycin g ½ and penicillin are given by injection twice daily and where vomiting is absent or as soon as it has subsided the patient is started at once on a full course of phthalylsulphathiazole by mouth A fluid diet only is allowed and liquid paraffin or subsequently a mild aperient such as milk of magnesia emulsion is also administered

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difficult by the oedema and inflammation in the bowel wall with the result that the sutures tend to cut out The line of closure is reinforced by suturing the omentum or any available *appendix epiploicae over the affected area but* even with this reinforcement there is the danger that leakage may occur in the post-operative period A proximal colostomy usually in the transverse colon must therefore be established in order to divert the faecal flow away from the diseased area

This procedure is sometimes suggested as the treatment of all perforations at whichever site in the colon they are to be found but it is to be remembered *that even though a proximal colostomy* is made the bowel distal to this still contains faecal material and this on its onward passage may burst the suture line and escape into the peritoneal cavity We therefore prefer to exteriorise the perforation and allow it to act as a colostomy wherever possible Usually the complete faecal flow is not interrupted by such a colostomy and although some will discharge on to the surface a proportion will be evacuated in the normal way This in itself is an advantage in that during the post-operative period the colostomy is likely to close of its own accord and a further operation may be avoided

In all cases where the perforation has not been brought out on to the *surface the wound is closed with drainage down to the site of the repair* Then if faecal leakage does occur the faeces will discharge on to the surface of the abdomen through the channel thus formed In those patients in whom the colon has been exteriorised and in whom established peritonitis is present with free pus in the abdomen drainage will also be required but in the early cases this is unnecessary

Post-operative treatment is especially directed towards combating the *peritonitis and any associated ileus Intravenous blood transfusion and glucose* saline therapy will be required and gastric suction is instituted as soon as the patient has recovered from the anaesthetic Antibiotics the administration of which is commenced as soon as the condition is diagnosed are continued in the first few post-operative days

Perforation with Pericolic Abscess Formation

This complication is far more common than perforation into the general peritoneal cavity although the abscess if left untreated may well break through the adhesions which limit its spread and so give rise to a secondary generalised peritonitis One of our patients a male aged sixty two was admitted complaining of left upper abdominal pain of one week s duration associated with general malaise and loss of appetite There had been no vomiting but his bowels had been more than usually constipated since the onset of his symptoms The history revealed increasing constipation of a year s duration but there had been no attack of diarrhoea and no bleeding or discharge of mucus with the stool On admission his temperature was 100° F and his pulse rate 100 He looked ill and on abdominal examination the only abnormality

was some tenderness in the left subcostal region Within a few hours of his admission he suddenly collapsed and died rapidly Post mortem examination revealed a generalised peritonitis with multiple diverticula in the left side of the colon In the region of the splenic flexure the bowel was acutely inflamed and surrounded by a very large abscess cavity There was an extensive perforation of one diverticulum and the sudden collapse had been due to a flooding of the general peritoneal cavity the result of a breach in the wall of the subphrenic abscess

The development of a pericolic abscess is normally associated with a less acute illness than that which is a preliminary to a perforation into the general peritoneal cavity and in some cases the initial constitutional symptoms are minimal Where the symptoms of acute diverticulitis initiate the complication it will be found that they quickly resolve with treatment but the local condition instead of subsiding spreads until a definite mass is palpable in the region of the affected part of the colon With the formation of the abscess the patient s condition which had improved declines again and the signs of toxaemia become apparent Sometimes thickening and reddening of the skin over the mass is present

TREATMENT Antibiotic therapy is at once commenced and the patient is prepared for operation The danger of leakage of pus into the peritoneal cavity or into a neighbouring hollow organ makes this a matter of urgency and the condition should not be treated conservatively once a diagnosis of abscess formation has been made

We consider that simple drainage of the abscess cavity through a skin incision placed over the area of infection is all that is required The colon is too firmly bound down by adhesions and oedema to consider attempting to mobilise it with the object of exteriorisation Moreover if a perforation is identified it is useless to try to repair the rupture as in the post-operative period the suture line will certainly break down Even should faecal material discharge the abscess cavity is so well walled off that there is no danger of its escaping anywhere except on to the abdominal wall A proximal colostomy serves no useful purpose and should not be performed It is unlikely to prevent the formation of a fistula and should this develop and fail to close will not cure the condition In such cases excision of the affected region of the colon on a subsequent occasion will be required

LOCAL NON SUPPURATIVE PERITONITIS

Although the inflammatory process associated with diverticulitis may extend into the structures outside the bowel wall abscess formation is not the invariable end result and instead a non suppurative local peritonitis may ensue The affected colon then becomes surrounded by a mass of acute inflammatory tissue in which coils of small intestine may become involved The condition may occur as a result of delay in the treatment of a case of acute diverticulitis or it may follow such treatment when resolution of the infection has not been achieved The symptoms of this complication are similar to those

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If a circle of skin is not removed from that part of the abdominal wall through which the proximal end of the colostomy is to be exteriorised stenosis of its orifice is extremely likely to result Colonic irrigations are then impossible and the colostomy will function unsatisfactorily



FIG 97
A completely defunctioning colostomy carried out in a case of diverticulitis complicated by complete obstruction A bridge of skin separates the two exteriorised ends of the transverse colon

Where an abdominal exploration has been undertaken the colostomy is fashioned by a similar method to that described above

Following the operation the distal end of the colostomy can be sealed with a dressing so that no faeces can spill into it and when post-operative irrigations through the colostomy and through the rectum have finally cleared the faeces in the distal colon symptoms rapidly settle The post-operative care of the proximal colostomy is similar to that described in Chapter IX

Subsequent Treatment About three months after the initial operation the diseased area of the colon is resected and continuity is restored by end to-end anastomosis Closure of the colostomy three weeks later completes the cure of the patient In carrying out this final operation *the two ends of the* colon must be dissected from their separate points of emergence through the abdominal wall The abdomen is then opened by enlarging the outer incision and a formal intraperitoneal end to-end anastomosis is completed

of acute diverticulitis though the fever the toxaemia and the local signs of tenderness and rigidity in the left side of the abdomen are less In place of the latter is a palpable mass which follows the line of the colon although it is less pronounced and less circumscribed than that associated with the formation of an abscess The abdomen may be distended as a result of involvement of the small intestine in the inflammatory process with consequent obstruction but obstruction to the large bowel sufficient to produce more than slight distension is uncommon in this stage of the disease

TREATMENT If the case is seen before any treatment has been given that described in dealing with the patient suffering from acute diverticulitis must be commenced Should this fail to produce rapid resolution of the symptoms or if the complication has followed treatment operation must be undertaken in order to short circuit the faeces away from the inflamed bowel by means of a transverse colostomy

Laparotomy and the Formation of the Colostomy Such a colostomy must allow no faecal material to enter the distal limb and this can only be achieved by severing the transverse colon completely and by exteriorising the two ends through separate skin incision

If there is any suggestion of distension of the abdomen prior to operation a full abdominal exploration must be undertaken so that an attempt can be made to free any obstructed coils of small intestine involved in the area of inflammation So great may be their involvement that their liberation may be impossible in which case a side to side anastomosis of the intestine above and below the area affected must be carried out In other cases damage to the small intestine may occur in separating the coils from the inflamed colon and a limited resection may be necessary

When exploration is deemed unnecessary the transverse colon is exposed through a small supra umbilical mid line incision A suitable position in its middle third is then chosen so that on exteriorising this the afferent loop is just taut After separation of the omentum from this region the bowel is crushed with de Martel s clamps and divided Its meso-colon is now incised backward towards its attachment for about 3 cm so that the ends of the colon can be separated

About 5 cm to the right of the upper part of the incision the skin is picked up with Kocher s forceps and a circle the size of a halfpenny is removed Through this gap a stab wound is made into the peritoneal cavity and through the hole thus formed, the proximal cut end of the transverse colon is drawn Its wall is carefully sutured to the peritoneum The distal clamped end of the colostomy is brought out through the upper end of the main wound the cut edge of the meso-colon between the two colostomy ends being sutured to the peritoneum of the anterior abdominal wall to prevent the possibility of a coil of gut insinuating itself between these two structures The wound is then closed The clamps are now removed from the ends of the bowel and the free edges are sutured accurately to the skin margin (Fig 97)

the Mayo clinic series male cases were five times as frequent as female The age incidence of the disease naturally follows that of diverticulitis and is therefore most common after forty although younger patients may be affected

SYMPTOMS The condition is preceded by abscess formation around a perforated diverticulum This becomes adherent to the bladder wall and sub sequently ulcerates into its cavity The minimal symptoms often associated with the formation of a pericolic abscess have been emphasised above and it is commonly the distress of the cystitis resulting from the faecal infection of the urinary bladder that brings the patient to the clinician rather than complaints referable to the bowel itself though close questioning may bring to light symptoms of diverticulitis to which the patient paid but scant attention The common symptoms therefore are of frequency and painful micturition often associated with suprapubic pain and sometimes with the passage of blood Some patients notice that the attack is initiated by a mucoid or purulent discharge through the urethra due to the sudden pouring of the contents of the abscess cavity into the bladder and their discharge through the natural passage during the act of micturition Flecks in the urine may have been observed also and the intelligent patient may liken these himself to faecal particles The classical symptom of the condition is the passage of air with the urine the patient noticing that on micturition the stream bubbles with gas This symptom though dramatic is by no means always present

The associated constitutional disturbances are often minimal and with an established fistula and the constant presence of faecal contamination of the urine the temperature and pulse rate may remain normal or but slightly raised Rarely an attack of pyelitis the result of an ascending infection may complicate the picture although involvement of the pelvis of the kidney may be direct if a pericolic abscess has formed in that portion of the colon in close relation to it and has discharged therein (Bockus 1947)

The rupture of a pericolic abscess into the bladder which itself has given rise to all the symptoms of an acute pericolic infection also occurs In such cases the symptoms referable to the diverticulitis may be relieved by the discharge of the pus into the bladder and its subsequent evacuation through the urethra and the patient may notice the coincidence of its discharge and the lessening of his abdominal pain The symptoms of a developed cystitis however soon replace those due to the pericolic abscess

Although the passage of air and faeces in the urine is common the reverse observation that of the passage of urine in the faeces is rare and in Mayo and Blunts large series referred to above but one patient noticed this symptom Urinary symptoms may complicate diverticulitis as a result of the spread of infection from the adjacent colon bound down to the bladder by inflammatory adhesions without the existence of a fistula In such cases the latter is likely to become established at a future stage in the disease if treatment for the disease of the bowel is not undertaken

Metastatic Suppuration

This rare complication is treated with chemotherapy and antibiotics

Fistulae Formation

These complications are discussed in subsequent paragraphs

SUB ACUTE DIVERTICULITIS

The symptoms of this condition are similar to those of acute diverticulitis although they are less marked Pain and tenderness in the left iliac fossa are slight and constitutional symptoms are minimal The temperature is seldom high The treatment of the condition is identical to that of acute diverticulitis

THE COMPLICATIONS OF SUB ACUTE DIVERTICULITIS

Fistula Formation The symptoms associated with acute diverticulitis are likely to bring the patient to the doctor at an early stage in the development of the disease so that should an abscess form around the colon it is probable that it will be recognised in the initial period of its formation and that prompt drainage of the pus will be effected as soon as the infection has localised Fistula formation is therefore a rare complication of the acute stage of the disease except in the neglected case

In sub acute and chronic diverticulitis however the local and constitutional symptoms may be so slight that although an abscess is forming around the diseased bowel it may pass unrecognised It is often not until the contents of the abscess cavity discharge into neighbouring viscera or on to the skin surface well away from the original site of the disease that attention is drawn to its presence Thus the symptoms of a vesico-colic or vagino-colic fistula or of a fistula in ano may be among the reasons that first cause the patient suffering from these stages of diverticulitis to report to his doctor

Entero-Vesical (Vesico-Colic) Fistula

The close proximity of the pelvic colon—the part of the bowel most frequently the site of diverticulitis to the bladder makes this complication one of the most common Edwards reports three cases occurring amongst seventy nine patients and Lett (1932) a similar proportion in a series of 172 though Mayo and Blunt (1950) analysing 202 consecutive cases of proven diverticulitis observed at the Mayo clinic found a higher rate of incidence forty six or 22 8 per cent having developed a fistula The intervention of the uterus between the colon and the bladder in the female provides some protection so that the condition is more commonly seen in the male patient and in

depression surrounded by oedematous and inflamed mucosa or by granulation tissue where ulceration around the orifice has taken place In such cases the appearances of a carcinoma of the bladder is simulated Sometimes faecal material may be seen protruding from the fistula into the bladder Sigmoidoscopy must be carried out but it is usually impossible to identify the colonic end of the fistula

The Choice of Treatment The treatment usually carried out for vesico colic fistula is to divert the faecal stream away from the fistulous communica tion by performing a colostomy placed proximally to the area of diverticulitis and generally made in the transverse colon Such a colostomy to be effective must short circuit the faecal flow in its entirety and is therefore fashioned in the manner described on page 186 In the past it has been customary to retain the colostomy for many months or even years before making an attempt to treat the fistula itself and even after such treatment the colostomy was usually retained permanently (Edwards)

We consider that in view of the modern aids to bowel sterilisation by means of chemotherapeutic and antibiotic measures this method of treatment requires careful re-consideration Firstly the colostomy alone although it may alleviate the acute symptoms in the acute case does not cure them completely nor does it prevent the onset of further complications in connection with the affected portion of the bowel such as the development of other pericolic abscesses Secondly if the lower bowel is defunctioned for many months or perhaps years it undergoes disuse atrophy and contraction so that even if the fistulous communication is subsequently repaired later closure of the colostomy is rendered impossible because of the gross diminution of the calibre of the distal bowel

Thirdly a colostomy cannot cure the granulating abscess cavity which lies between the colon and the bladder It is true that it can prevent further gross contamination once the faeces distal to the colostomy have been evacu ated but the chronic abscess cavity remains as a source of infection A low grade cystitis often associated with periodic acute inflammatory flare ups is almost certain to persist and a colostomy therefore can only be regarded as a method of palliation in the treatment of the disease

Following a colostomy attempts are sometimes made to cure the fistula by dissection of the communication between the bladder and the colon and by closure of the perforation present in each organ Too often however this fails to prevent a recurrence and suture of the omentum between the two structures reduces the recurrence rate but slightly Moreover should the operation be successful thus allowing the colostomy to be closed fibrosis may well occur in the diseased segment of the colon with the result that obstruction may develop In addition further attacks of diverticulitis are probable as complete resolution of such an extensive degree of inflammatory change as has affected the colon in which a fistula has developed is unlikely

DIFFERENTIAL DIAGNOSIS In the past vesico-colic fistula was associated most commonly with infection of the fallopian tubes but with modern chemo therapy and antibiotics this cause is far less frequent Cancer of the colon can also give rise to the condition though when associated with this disease it occurs in the more advanced cases when the growth has spread widely outside the bowel wall and has infiltrated the bladder Crohn s disease tuber culosis peritonitis and ulcerative colitis are all rarely the cause of such fistulae



FIG 98
Barium passing into the bladder from the colon in a case of vesico colic fistula

INVESTIGATIONS A barium enema will usually reveal the fistulous track (Fig 98) although periodic obliteration by an impacted faecal particle or by oedema the result of an acute flare up of the inflammation at one or both orifices may prevent visualisation at the time of the examination The amount of barium that is allowed to flow into the rectum should be sufficient only to fill the pelvic colon as if the fistulous track is of wide calibre considerable leakage of barium into the bladder will occur The X ray will also help in the differential diagnosis between diverticulitis and carcinoma where doubt exists as to the cause of the fistula

Examination of the urine does not always reveal a heavy B coli infection and indeed in some cases it may be sterile on culture Cystoscopy must always be carried out The bladder mucosa often shows surprisingly little sign of a generalised inflammatory reaction except when the symptoms of a cystitis are severe The opening of the fistula into the bladder is usually identifiable as a

depression surrounded by oedematous and inflamed mucosa or by granulation tissue where ulceration around the orifice has taken place In such cases the appearances of a carcinoma of the bladder is simulated Sometimes faecal material may be seen protruding from the fistula into the bladder Sigmoido scopy must be carried out but it is usually impossible to identify the colonic end of the fistula

The Choice of Treatment The treatment usually carried out for vesico colic fistula is to divert the faecal stream away from the fistulous communica tion by performing a colostomy placed proximally to the area of diverticulitis and generally made in the transverse colon Such a colostomy to be effective must short circuit the faecal flow in its entirety and is therefore fashioned in the manner described on page 186 In the past it has been customary to retain the colostomy for many months or even years before making an attempt to treat the fistula itself and even after such treatment the colostomy was usually retained permanently (Edwards)

We consider that in view of the modern aids to bowel sterilisation by means of chemotherapeutic and antibiotic measures this method of treatment requires careful re-consideration Firstly the colostomy alone although it may alleviate the acute symptoms in the acute case does not cure them completely nor does it prevent the onset of further complications in connection with the affected portion of the bowel such as the development of other pericolic abscesses Secondly if the lower bowel is defunctioned for many months or perhaps years it undergoes disuse atrophy and contraction so that even if the fistulous communication is subsequently repaired later closure of the colostomy is rendered impossible because of the gross diminution of the calibre of the distal bowel

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On these considerations it would therefore seem essential that a planned treatment for the cure of the condition must include an excision of the diseased segment of the colon

It has been explained that the majority of the fistulae occur in the sub acute or chronic type of case in which the toxicity of the infecting organism is so low that a generalised systemic reaction does not develop Moreover the infection around the colon has been present for some considerable time so that it and the bladder are normally bound together by chronic inflammatory adhesions and not by acute oedematous inflammatory tissues We therefore consider that in many cases it is possible under a screen of antibiotics and chemotherapy to carry out with complete safety a dissection and separation of the fistulous track between the colon and the bladder an excision of the diseased bowel with immediate end to-end anastomosis and a closure of the opening into the bladder as a one stage operation without a preliminary colostomy This method of treatment we have carried out in recent cases and the successful outcomes with uneventful convalescence have convinced us that it is the one of choice

In certain cases the inflammatory reaction in the pelvis may be so extensive that dissection of the colon and its separation from the bladder is impossible without endangering these and adjacent structures These occasional cases must be treated by a preliminary transverse colostomy and further exploration with a view to excising the diseased colon undertaken after an interval of four months By the end of this time much of the inflammation will have subsided and a permanent cure can be achieved along the lines indicated above

Where fistula formation complicates an acute stage of diverticulitis the partial drainage of the abscess into the bladder and its discharge through the urethra may produce amelioration of the symptoms In such cases conservative treatment may well serve to convert the acute into a sub acute or chronic case when the fistula can be cured by the one stage operation referred to above If however acute symptoms persist and are not rapidly relieved by antibiotics and chemotherapy then a transverse colostomy must be instituted and the excision of the colon and the repair of the fistulous opening into the bladder delayed for a future operation

Although at operation a considerable extent of the bowel may be found to be affected with diverticulosis the inflammatory element is usually limited to a short length of the colon only and where a vesico-colic fistula is present it is a part of the pelvic colon that is involved Its lower part in the region of the pelvi rectal junction is often unaffected and even should this be involved the upper part of the rectum remains free of change in the vast majority of cases Upwards the inflammatory changes may not extend as far as the descending colon There is the possibility therefore of excising the grossly diseased region of the bowel and effecting an end to-end anastomosis of regions into which the inflammation has not extended If the descending colon is involved and thus requires excision the transverse colon will certainly

be free and can be mobilised sufficiently to enable it to be anastomosed to the pelvi rectal junction or upper part of the rectum It is indeed true that diverticula may exist in the upper limb of the bowel proximal to the site of the excision but if the presence of the diverticula is appreciated and the necessary treatment described in a previous section undertaken after operation to prevent their becoming inflamed subsequent complications the result of their presence are improbable

A planned treatment of cases of vesico-colic fistula is therefore in the acute case to attempt its conversion into a sub acute or chronic one and in the latter after suitable preparation to excise the affected region of the colon and to restore continuity by an end to-end anastomosis of the bowel above and below the region of the excision Many adhesions will be encountered during the operation but it is possible to separate and divide these without injury to other structures During this part of the operation a small abscess cavity surrounding the fistulous communication may be opened but by suitably placed packs the general peritoneal cavity is protected from any spilling and in any case after preliminary pre-operative preparation of the patient its contents are almost certain to be sterile

Pre-operative and Operative Detail The pre-operative preparation of the patient follows the lines laid down for that carried out prior to an excision for carcinoma The preliminary washouts however must be performed with care as leakage of fluid through the fistulous track into the bladder may flare up the cystitis If there is any accentuation of the symptoms of cystitis or recurrence of the abdominal pain of the diverticulitis the washouts must be abandoned and a residue free diet and purgation relied upon to empty the colon of its retained faeces

Sterilisation of the bowel content is achieved by administering orally a full course of phthalylsulphathiazole or of guanimycin or by giving 0 25 g of aureomycin four times a day for the last three days prior to operation

The abdomen is opened through a left paramedian incision and when the peritoneum has been incised the table is tipped into the Trendelenburg position and the coils of the small intestine are packed off into the upper part of the peritoneal cavity Some of the coils may well be involved in the adhesions binding the colon to the bladder and will require careful separation before this can be achieved

The adhesions between the colon and the bladder are then divided and as mentioned above a chronic abscess cavity usually of small size and surrounding the fistula will be opened during this stage of the operation The identification of the opening between the bladder and the colon is usually easy and will be revealed as the colon is separated away by dissection with small gauze swabs aided by a few cuts with the scissors

The dissection between bladder and colon is continued downwards through and below the fistula until the peritoneal reflection from the rectum on to the bladder is clearly seen At this stage attention is turned to the peri

toneal reflections from the pelvic colon above the fistula on to the lateral abdominal wall on the left side and the postero lateral on the right These are incised fairly close to the colon and the incisions on either side are carried downwards into the pelvis



FIG 99A



FIG 99B

FIG 99A and B

Part of the pelvic colon excised by a one stage operation for vesico colic fistula A marker has been inserted into the perforated diverticulum

The extent of the diseased bowel and therefore of that part which will require excision must then be determined Where the perforation involves the upper part of the pelvic colon its lower portion may be free of any gross inflammatory change and in such cases is suitable for anastomosis If the main region of diverticulitis and the perforation is at a lower level the colon and the rectum just above the peritoneal reflection will almost certainly be thickened and inflamed so that the anastomosis must be made beyond this

level to the upper part of the rectum below the peritoneum of the pouch of Douglas Similarly the upper limit of the proposed excision must be determined Usually the upper part of the pelvic colon or lower descending colon contain minimal changes and can be employed for the subsequent anastomosis In the rare cases where extensive disease involves the descending colon the whole of this region will require excision and for the restoration of continuity the distal part of the transverse colon must be employed This can be mobilised in the manner described in Chapter VII and there is no difficulty in achieving sufficient mobility to enable it to be brought down well into the pelvis so that it may be anastomosed either to the rectum or the lower part of the pelvic colon without tension

Having made the decision as to the extent of the excision this region of the bowel is mobilised by raising it towards the mid line and by dividing the many bands of fibro fatty tissue in its meso-colon more marked in diverticulitis than in the normal bowel which bind the gut to the posterior abdominal wall The ureter on each side is identified and traced down well into the pelvis As a result of old pericolic inflammation its course may be disturbed from the normal and it may be closely adherent to any part of the colon or the meso-colon which is to be excised If at this point in the dissection however it is fully exposed there is no danger that it will be damaged at a later step in the operation

If it has been decided that the anastomosis is to be made to the upper end of the rectum the latter is mobilised by incising its peritoneal reflection on to the bladder or uterus and by separating it from the lower part of the bladder and the upper part of the prostate in the male and from the vagina in the female Posteriorly its loose attachment to the sacrum is stripped and on either side the upper portions of the lateral ligaments are divided

The meso-colon of that part of the colon to be excised is then divided between artery forceps but unlike the excision carried out for carcinoma it is severed quite close to the mesenteric margin of the bowel as no attempt is being made to remove the area of lymphatic drainage contained therein Moreover if the meso-colon is cut across close to the margin of the bowel none of the main arteries will be severed so that there is no danger of interfering with the blood supply of portions of the colon apart from that which is to be excised

Crushing clamps are applied to the bowel at the upper and lower limits of the region of the colon to be removed and a soft clamp to the colon above this level and if feasible below it The colon is then cut across between the clamps but care is taken to see that the line of section does not traverse a diverticulum as the presence of this weakened area in the subsequent line of suture might possibly be the cause of its post-operative breakdown The subsequent anastomosis of the cut ends is carried out in a manner identical with that described in dealing with cancer of the colon

The edges of the perforation into the bladder are then excised and the opening is closed with two layers of catgut It then remains to re peritonealise

any raw edges in the posterior abdominal wall after which the wound is closed with drainage down to the area of anastomosis At the completion of the operation a self retaining catheter is passed and so secured that it will not be *disturbed from its position in the post-operative* period

The post-operative care is the same as that discussed in Chapter IX with the exception that the catheter is maintained in position for ten days The latter is connected to a drainage tube *the end of which leads to a Winchester* bottle partially filled with an antiseptic solution The drainage is thus constant and free There is no possibility that the bladder may become distended with the risk of resultant rupture of the suture line in its wall During the whole period in which the catheter is present twice daily injections of crystalline penicillin are given

We have found that by these methods a safe and lasting cure of the fistula can be achieved The prevention of further infection arising in other diverticula that may be present lies in the treatment of the diverticulosis which has been described previously Figures 99A and B illustrate a part of the colon so resected for vesico-colic fistula

Vagino Colic Fistula

The discharge of pus faeces and air per vagina is diagnostic of this condition Again although such a fistula may result from an infection of the fallopian tubes from ulcerative colitis from the discharge of an appendix abscess or occasionally as a result of intestinal tuberculosis or Crohn s disease diverticulitis as a cause of this fistula ranks high A previous history of diverticulitis will support the diagnosis of its cause and a barium enema examination may demonstrate the fistulous communication

The perforation in such cases is likely to involve the lower part of the pelvic colon and the infection to extend well down into the rectum *thus ruling out the possibility of a one stage excision with* anastomosis It is probably best in dealing with this complication to institute a transverse colostomy as an initial stage in the treatment and to follow this with antibiotics to control the infection At a later stage some three months later the abdomen should be re-explored and the pelvic colon and rectum dissected away from the many adhesions binding it down to the vagina and neighbouring structures Resection of the region of the colon containing the perforation with restoration of continuity in the manner described above is then performed and the perforation into the vagina sutured Some six weeks later the transverse colostomy is closed

Entero-Cutaneous Fistula

A cutaneous fistula in the abdominal wall may well arise as the result of a natural perforation *of a peri-colic abscess which following the involve* ment of the abdominal musculature has discharged on to the skin surface or it may follow the surgical incision of such an abscess in an earlier stage of

its development Most fistulae after the initial discharge of pus allow the escape of faeces and flatus in varying degrees

It is not always through the abdominal skin that a pericolic abscess finds its way to the surface The abscess may become adherent to the peritoneum covering the upper surface of the levatores ani muscle and it may ulcerate through this into the fibro fatty tissue of the ischio rectal fossa subsequently reaching the skin surface covering this region An ischio rectal abscess can thus be the result of an infection above the pelvic diaphragm and if following the incision and drainage of the pus from such a condition the wound fails to heal and remains as a discharging sinus the possibility of an existing communication with the bowel must not be forgotten In such long and often tortuous tracks the passage of flatus or faeces through the external orifice may be absent but a history suggestive of diverticulitis or the presence of an inflammatory mass in the region of the pelvic colon at the time of the onset of the ischio rectal infection may help in the diagnosis of its origin

A barium enema should be carried out It is unlikely that the barium will escape into the fistulous track but the presence of many diverticula or the partial obliteration of the lumen of the pelvic colon as a result of fibrosis or oedema is suggestive that a perforated diverticulum may be the cause of the fistula Injection of the track with lipiodol will sometimes show its tortuous extent passing well above the diaphragm of the pelvis formed by the levatores ani muscle

All of these high level ano rectal fistulae are not due to the condition under consideration They may be associated with infection of the fallopian tubes ulcerative colitis Crohn s disease or tuberculosis or occur as the result of perforation of the wall of the pelvi rectal region by some food particle Such causes must of course be excluded before attributing the presence of the fistula to the diverticulous state of the colon

Treatment of a Fistula, the Cutaneous Opening of which lies on the Abdominal Wall A developed fistula on the abdominal wall may undergo healing and natural closure and a period of two or three months should be allowed in the hope that this may occur During this time courses of antibiotics and colonic irrigations are given The faecal discharge is often quite small the bulk of the stool being passed normally and the main complaint of most of these patients concerns the uncontrollable passage of flatus and not the periodic escape of faeces The inflammation in the affected region of the colon may well resolve in this period and if following the natural closure of the fistula the patient is put upon the regime suggested for diverticulitis he may experience little further trouble In other cases however in spite of a natural closure periodic attacks of inflammation associated with pain and constitutional disturbance recur Further pericolic abscesses may follow with the possibility of their perforation into the neighbouring structures other than the abdominal wall These complications indicate that resection of the affected region of the colon is necessary for the cure of the condition

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During the post-operative period there is a tendency for the superficial portions of the wound to heal over before those more deeply situated have been obliterated by granulation tissue and fibrosis This must be prevented as should it occur a residual track extending upwards to varying degrees will remain and this will be the source of repeated flare ups of infection Immediately after operation therefore the pyramidal wound is packed with cotton wool soaked in an antiseptic solution We have recently been using Bradosol for this purpose as wool soaked in such solutions as perchloride or biniodide of mercury tend to become very adherent to the walls of the wound and are difficult to remove This dressing is removed at the end of forty-eight hours when the wound is irrigated and repacked the process is repeated every other day As granulation at the top of the wound occurs and the apex of the cavity becomes progressively obliterated so the packing is placed less deeply until finally the superficial areas of the wound are allowed to epithelialise

Three months after the initial operation the abdomen should be re-explored with the object of excision of the affected area of the colon The colostomy is then closed after a further interval of three weeks

Entero-Intestinal Fistula

Such a condition may be discovered at operation as an incidental finding associated with other complications of the disease Pre-operative symptoms may not have suggested its presence (Fig 100) Symptoms of gross diarrhoea are likely only if the communication is large enough to short-circuit much of the content of the small intestine into the colon at low level and this complication is rare

The treatment consists of excision of the diseased colon and repair of the opening in the small intestine

Large Bowel Obstruction

In the sub acute and chronic stage of the disease obstruction is common This is rarely absolute and usually consists of periodic sub acute attacks

The clinician may well experience difficulty when seeing the case for the first time in deciding whether the obstruction is due to an inflammatory condition of the bowel or whether it is the result of a carcinoma The obstructive symptoms are of course identical in the two conditions and other factors must be taken into consideration in establishing the differential diagnosis Previous attacks of a similar nature sometimes spaced at intervals over several years a history of periodic pain in the left side of the abdomen and at the time of the examination the identification of tenderness in this region the good general condition of the patient associated with recent increase in weight or certainly no weight loss are all points that will suggest that the lesion is due to diverticulitis and not to a carcinoma The presence of a slight fever with some rise in the white blood cell count is also in favour

In those patients in whom after the passage of a reasonable length of time the fistula persists surgery should also be advised for its closure Oftentimes when the fistula has been present for several months the granulation tissue of the track leading down to the bowel is replaced by intestinal mucosa which has grown up to meet the skin surface In such cases the surgeon may well be tempted to dissect out this mucosal tube and to invaginate it into the main lumen of the colon subsequently reinforcing the site of perforation by over running sero muscular sutures In our experience this method of closure is too often associated with subsequent breakdown of the line of suture and therefore of a re formation of the faecal fistula to make it a worthwhile procedure except in those cases in which it is judged that the general condition of the patient will not permit a more extensive operation Moreover this procedure does not relieve the patient of the possibilities of further attacks of inflammation in the affected colon We consider that wherever possible the involved region of the bowel containing the fistula should be excised and an immediate end to end anastomosis carried out The initial preparation of the bowel follows along the lines previously indicated and the isolation of the diseased section of the colon and subsequent resection and anastomosis is similar to that described in dealing with vesico colic fistulae

Where the fistula opens on to the skin covering the ischio rectal fossa it is unlikely to heal until that portion of the colon with which it is in communication is excised or at least defunctioned The infection involves in these cases not only the pelvic colon but the upper part of the rectum as well and both of these structures are swollen with oedema and inflammatory tissue An immediate excision of the affected region with immediate end to-end anastomosis cannot therefore be carried out with safety and a defunctioning transverse colostomy must first be made to divert the faecal flow away from the site of the disease

The infected track in the ischio rectal region is also dealt with at this operation A pyramid of skin and ischio rectal fat centred upon the fistula and with its apex extending as high as the levatores ani muscle is excised so that in the post operative stage the depths of the wound are likely to heal before the surface wound is epithelialised over The perforation in the muscle through which the abscess cavity lying above it has discharged is often small and if the condition is of long standing its margins are hardened with fibrosis Such an opening must be enlarged so that the drainage from the abscess cavity above will be adequate thus giving it every chance to contract down and to become obliterated by the natural processes of healing

In enlarging the perforation in the levatores ani muscle the incision must always be carried outwards and never inwards as if it is made in the latter direction there is every possibility that some of the fibres of the pubo rectalis may be damaged This muscle runs round the rectum at this level in the form of a sling and it is upon its integrity that continence finally depends It must therefore be left intact



FIG 101

A barium enema X ray of an obstructive lesion subsequently proven to be due to diverticulitis The X ray is indistinguishable from that of an obstruction due to a carcinoma



FIG 102

A similar X ray to that shown in Fig 101 except that the outlined diverticulum suggests the cause of the obstruction

of a non malignant cause for the obstruction although where a pericolic infection complicates a cancer a similar picture will result

The obstruction resulting from diverticulosis as shown in a barium enema may be indistinguishable from that in which the cause is carcinoma (Fig 101) Sometimes a diverticulum may be outlined and its presence will lend probability to the former diagnosis (Fig 102)



FIG 100
A barium enema X ray showing a fistulous communication between the lower part of the pelvic colon and the small intestine

The occasional possibility that a small cancer exists in association with the diverticulitis and that this is responsible for the final obliteration of the lumen of the colon already reduced by inflammatory change must not be overlooked Such a growth may not as yet have produced any change in the general constitution of the patient or have given rise to any symptoms by which its presence could be differentiated from the co-existing diverticulitis

Treatment In absolute or severe incomplete obstruction the abdomen must be explored and a defunctioning colostomy instituted Laparotomy rather than a blind colostomy is advisable for the reasons discussed in Chapter VIII In addition in the difficult diagnostic case it may only be at laparotomy that the surgeon is able to make a differential diagnosis between carcinoma and diverticulitis as the cause of the obstruction The finding at



FIG 103A



FIG 103B

FIG 103A and B

Pre and post operative X rays from a patient who had suffered from periodic attacks of sub acute intestinal obstruction due to diverticulitis The affected region of the colon was excised by a one stage operation

operation of gross inflammation sometimes matting together the whole of the pelvic contents in a solid mass may be the final indication of the non malignant cause of the condition

This differential diagnosis is an important one to make If the obstruction is found at laparotomy to be due to a carcinoma the period of delay between the formation of the colostomy and the resection of the colon must obviously be reduced to a minimum If due to diverticulitis however it is preferably prolonged for several months in order to allow all the inflammation to subside Occasionally even at laparotomy it is impossible to distinguish the two conditions Such cases must be regarded as carcinomata and subsequent operation undertaken at the earlier date

Antibiotics and chemotherapy are administered in the immediate post operative period Colonic irrigations through the rectum are commenced after five or six days to clear the diverticula of their contained faecoliths

Four months later after suitable preparation of the bowel the abdomen is opened In all except the occasional case the inflammation about the diseased colon will then be found to have resolved almost completely and resection with end to end anastomosis can be undertaken Three weeks later the colostomy is closed

In the occasional case in which because of persistent fibrosis and matting together of the pelvic colon and its adjacent structures their separation is impossible the abdomen must be closed and re-explored at the end of a further year Only the very rare case will then remain in which because of failure of absorption of the pericolic fibrosis excision is still not possible and in such a colostomy will have to be retained permanently

In **incomplete obstruction** endeavours must be made to overcome the condition by conservative measures Colonic irrigations are administered and antibiotics and chemotherapy are commenced The former therapy will dislodge faeces impacted in the colon and the latter by controlling the infection will reduce the oedema in the bowel wall to which much of the obstruction is due As soon as it is apparent that the abdominal distension is subsiding and that the irrigations are returning faecal content mild aperients will help by producing a semi solid or fluid motion Only if this treatment fails to relieve the obstruction should laparotomy with the establishment of a colostomy be carried out

Although the immediate obstruction may have been overcome by such measures it is likely to recur It is probably wise therefore to advise that *most cases should undergo a resection of the affected area* This after suitable pre operative preparation of the bowel can be undertaken as a one stage operation without a colostomy (Fig 103)

SMALL INTESTINAL OBSTRUCTION

This may occur either alone or in association with large bowel obstruction the result of the small intestine having become involved in the pericolic inflammation



Fig 104A



Fig 104B

Fig 104A and B

Pre and post operative X rays from a patient suffering from local non suppurative peritonitis secondary to a perforated diverticulum The associated obstruction was relieved by conservative treatment following which the affected region of the colon was excised by a one stage operation

If the diagnosis of simple obstruction is a certain one the condition should be treated conservatively with gastric suction and intravenous fluid replacement but where doubt exists or where the obstruction is not rapidly relieved by such methods laparotomy should be undertaken At operation coils of small intestine are likely to be found bound down to the inflamed colon and these must be separated by careful dissection Damage to the intestine may be unavoidable necessitating repair or in some cases resection In other cases fibrinous bands the result of the diverticulitis may be producing the obstruction and these will require division in order to liberate the small intestine

Where the initial examination of the patient has suggested that a strangulation is present laparotomy must be undertaken as soon as the general condition has been sufficiently improved by pre-operative treatment with intravenous saline blood transfusion and gastric suction

Local Non Suppurative Peritonitis

This condition may complicate a sub acute attack of diverticulitis in which the constitutional symptoms are minimal and in which until the peritonitis develops few signs except tenderness in the left iliac fossa are present With the extension of the infection outside the bowel wall and the walling off of such infection by low grade inflammatory tissue a mass soon becomes palpable This may well settle with the conservative treatment previously indicated but in some cases in spite of all types of antibiotics and chemotherapy and colonic irrigation resolution is not complete Constipation is usually marked owing to some degree of obstruction and a tender painful mass persists in the left side of the abdomen In such cases operation must be undertaken

In view of the low grade nature of the infection and the fact that even although it is not absolutely inhibited it has been controlled by antibiotics and chemotherapy we consider the affected region of the colon can be excised and continuity established in a one stage operation without the necessity of a preliminary transverse colostomy Planes of cleavage between the pericolic inflammatory adhesions and the surrounding structures are usually easily identifiable and below and above this area healthy bowel can be isolated Provided the excision and subsequent anastomosis is made through such regions it can be carried out safely following the technique previously described Figures 104A and B and 105 illustrate the X rays and excised specimen of a patient so treated A preliminary defunctioning colostomy need be instituted only if such a dissection endangers any structures bound together in the inflammatory process In these cases resection is undertaken some months later

CHRONIC DIVERTICULITIS

Periodic attacks of sub acute inflammation even though they eventually settle leave the wall of the affected area of the colon infiltrated with fibrosis The contraction of the latter slowly obliterates the lumen of the bowel so



FIG 106
Filling defect in the pelvic colon due to diverticulitis but simulating a carcinoma



FIG 107
Filling defect associated with diverticulitis but which at operation was found to be due to a carcinoma

that obstructive symptoms are likely to develop The treatment of this complication and of fistula formation which may also result is similar to that detailed previously

THE RELATION OF CANCER OF THE COLON TO DIVERTICULITIS

There seems to be no definite evidence that the inflammatory change associated with diverticulitis is productive of cancer in the affected colon Both diseases have a common age incidence and their presence together is therefore likely to be coincidental In an exhaustive review of the literature



FIG 105
The affected region of the colon removed by a one stage operation from the patient the X rays of whom are shown in Fig 104

Rowe and Kolmar (1952) could find only sixty two cases of carcinoma and diverticulitis existing simultaneously in the same sector of the bowel and they emphasised the coincidence of such an occurrence and the lack of any pathological evidence linking the two conditions

DIFFICULTIES OF X RAY DIAGNOSIS

Although the X ray findings of diverticulitis may be typical and leave no doubt as to the nature of the lesion periodic cases occur in which as a result of spasm or oedema and inflammation in the wall of the affected colon a filling defect is produced which may simulate exactly that due to an early carcinoma (Fig 106) On the other hand a filling defect associated with an area of diverticulitis may be attributed to this cause when actually due to an

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associated carcinoma (Fig 107) Lloyd Davies (1953) has drawn attention to the value of Banthine in eliminating any associated spasm of the colon in cases of diverticulitis and if 100 mg of the bromide salt are given before the barium enema relaxation will be effective and errors in diagnosis will be reduced

Nevertheless the case will present occasionally in which a definite diagnosis cannot be established by X ray examination or clinical study Where doubt exists operation should be undertaken and even then the surgeon may not be certain of the nature of the swelling with which he is dealing In such cases wide excision of the affected area of the colon should be carried out

SOLITARY DIVERTICULA OF THE CAECUM

A generalised diverticulosis of the large intestine may well involve the caecum but the presence of a solitary diverticulum is rare The latter condition will almost certainly escape notice unless perhaps as the result of the impaction of a faecolith in its cavity inflammatory changes ensue when the symptoms and signs to which it gives rise will simulate those of an appendicitis Anderson (1947) describes six cases of the condition amongst seven hundred cases of diverticulitis of the large intestine for which surgery was undertaken Recently Lauridsen and Ross (1952) when reporting a further four cases of their own reviewed the literature and found records of a total of 149

When the condition is recognised at operation the diverticulum should be excised together with a surrounding base of the wall of the caecum It is advisable to remove a portion of the wall of the caecum and not to remove the diverticulum alone as sounder stitching can be achieved if the sutures are inserted into the caecum somewhat away from the area of acute inflammation Ellis and Windham (1952) describe a case in which because the wall of the caecum was diffusely involved in the inflammatory process making it likely that the stitches would not hold the area of suture was exteriorised This device may well be valuable where the inflammatory change in the caecal wall is extensive

If the inflammatory changes are less acute the infection may become localised with the formation of a mass in the right iliac fossa sometimes simulating a carcinoma Even at operation the diagnosis may be uncertain and the operator may feel compelled to carry out a hemicolectomy Wherever possible however more minor methods should be used as in recorded cases the mortality associated with this treatment is above 7 per cent

The ultimate development of cancer in long standing cases of ulcerative colitis is now well appreciated and the possibility of this change must be an added consideration when operation is advocated in the chronic case Cattell and Sachs (1948) reported an incidence of 7 per cent of developed cancer amongst patients they had operated upon for ulcerative colitis whilst Sloane Bargen and Baggenstoss (1950) analysing a series of 2 000 cases noted carcinomatous changes in 5 per cent Gabriel (1952) likewise emphasises the marked incidence of malignant change and in his series of sixty-eight cases treated surgically cancer had developed in 6 or 9 per cent



FIG 108
Barium enema X ray from a patient suffering from ulcerative colitis The straight outline and lack of normal curve in the terminal ileum shows that the disease has spread back through the ileo caecal valve to involve this part of the bowel as well

In reporting five further cases of carcinomatous change in a series of 126 patients MacDougall (1954) estimates that carcinoma of the large intestine is found at least five times as frequently in patients suffering from the disease as in the normal adult population He also draws attention to the relatively early average age at which these changes commence compared with those in whom cancer is a primary disease

Recently Shands Dockerty and Bargen (1952) reported seventy three cases in whom adenocarcinoma had supervened in chronic ulcerative colitis and examining thirty two specimens removed for complications other than

CHAPTER XIII

ULCERATIVE COLITIS

PATHOLOGICAL CONSIDERATIONS

ULCERATIVE colitis is a condition in which the mucosal lining of the whole or of a part of the large bowel from the caecum to the lower rectum is involved in an inflammatory process of unproven aetiology with resulting widespread ulceration In some advanced cases the disease process is not limited to the large bowel but spreads through the ileo-caecal valve which normally marks its most proximal extent to involve the more distal coils of the small intestine (Fig 108) It is suggested by Brooke (1951) that these patients in whom the ileum is involved may be suffering from a different disease but the identical nature of the lesions in the colon to those found in cases in which the small intestine is free from involvement makes this unlikely

Not only does the extent of the length of bowel involved vary but also the degree of ulceration In some cases it may be minimal the majority of the mucosa being merely swollen with oedema and bleeding easily on pressure from an examining sigmoidoscope whereas in others large areas of the bowel wall are denuded of their mucosal covering the remnants of which are shredded and free of attachment to the underlying submucosal layers (Fig 109)

The whole of the large bowel may be uniformly affected by the condition but it is not uncommon to find that the pelvic colon is the site of the grossest pathological change the severity of these changes fading as the bowel is traced upwards and downwards away from this region

Although undoubtedly starting in the mucosa the underlying layers of the bowel wall soon become infected probably as a result of secondary infection by the flora normal to the intestinal content We have operated upon an early case of ulcerative colitis in which appendicitis was an added complication and at the time of operation the whole of the outer wall of the large intestine appeared normal although pre-operative sigmoidoscopy had shown the generalised ulcerative condition of the mucosal lining Several months later when operation was undertaken for the ulcerative colitis the colon in its entirety was sodden and thickened as a result of inflammatory changes that had now extended through its walls

As a result of the involvement of the full thickness of the bowel wall in these inflammatory changes its substance may be so destroyed that perforation ensues with the development of a localised pericolic abscess or of general peritonitis In other cases subsequent fibrosis may even give rise to obstruction It is in these areas of fibrosis too that as Counsell and Dukes (1951) have pointed out carcinomatous changes may occur This is especially likely in those cases in which the disease has been present for many years

carcinoma they found that in two there was evidence of malignant change both of which they claim were associated with the presence of pseudopolyps These authors state that although in some cases the transition between the



FIG 110A and B
Photomicrographs of a true adenoma and a pseudopolyp to show their comparative structure In the true polyp the normal mucosal surface is seen compared with the ulcerated covering of the pseudopolyp The adenoma also shows the two layers of muscularis cut across at its pedicle

inflamed mucosa and frank developed carcinoma is sometimes sharp and well defined in others the change is a gradual one the alterations of the cell nucleus associated with the chronic inflammation changing imperceptibly into those of malignancy

It is fair to state however that the possibility that malignant change can take place in the pseudopolyps of ulcerative colitis without associated fibrosis is not a generally accepted fact Felson and Wolarsky (1949) reporting on fifty five patients with chronic ulcerative colitis the majority of whom had had the disease for many years stated that in no case in their series was there any evidence of malignant change and that they had never noted active proliferation of epithelium in pseudopolyps to the point of neoplasia They point out the very different formation of an inflammatory pseudopolyp from an adenoma (Fig 110) the possible change into malignancy of which is widely recognised Moreover these authors have observed the recession of pseudopolyp formation as the disease regressed Counsell and Dukes are also of the opinion that cancerous changes do not develop in inflammatory pseudopolyps but only in association with true adenomata the presence of which is sometimes associated with ulcerative colitis

Although therefore the development of cancer changes in association with areas of fibrosis is certain (Figs 19 111) it seems that malignant degeneration in inflammatory pseudopolyps is very rare if it occurs at all and that

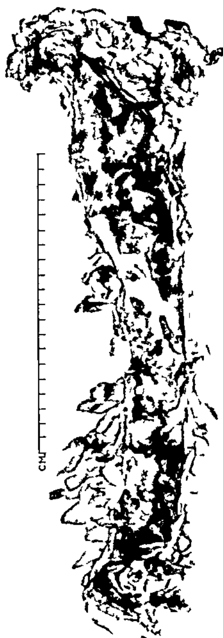


FIG 109
A part of the colon affected by ulcerative colitis showing multiple pseudopolypoid formation and the large areas of associated ulceration

their presence cannot be put forward as an indication for operation on the grounds of the likelihood of carcinomatous change

AETIOLOGICAL FACTORS IN THE DISEASE

The aetiology of this condition still remains obscure and until this is elucidated the response of the disease to various forms of medication and treatment are likely to be uncertain The characteristic appearance of an acute inflammatory process involving the mucosal lining of the colon naturally suggests a specific organism as its cause but in spite of the investigations of many workers none has been isolated At one time Bargen (1924) attributed the disease to a diplostreptococcus but a critical investigation of its role by Paulson (1933) and later by Friedenberg and Wolepor (reported by Bockus 1936) failed to substantiate the strong claims put forward that this was the causal organism

In most cases there is little evidence that vitamin deficiency plays any part in the initiation of the condition and the avitaminosis that complicates the later stages of the disease is almost certainly secondary and due to the diminished food intake and its rapid passage through the intestinal track The phenomenon of allergy has been invoked to explain the mucosal changes but no inciting agent has been proven or isolated The possibility that the disease may be of psychogenic origin has also been suggested but whilst it is true that a large number of sufferers from the disease have a peculiar mental make up the role of the emotional factor is uncertain

In 1949 Meyer Gellhorn Prudden Lehman and Steinberg drew attention to the isolation in the stools of patients suffering from ulcerative colitis of high concentrations of an enzyme lysozyme This a bacteriolytic and mucolytic agent which in the normal subject may be isolated from the saliva the tears and the nasal secretions In the normal stool of a fit person it cannot be identified The authors suggest that by its power to destroy mucus the natural protective covering of the cells lining the large bowel is removed These cells are then exposed to proteolytic digestion from the normal enzymes and afterwards to secondary infection from the usual flora of the large bowel Florey in 1933 had suggested that these organisms are normally prevented from invading the wall of the bowel by the protective covering layer of mucus They also demonstrated in support of this theory that in animal experiments in which large concentrations of the enzyme were brought into contact with isolated loops of gut changes similar to the initial stages of ulcerative colitis were produced Attention was also drawn to the fact that with clinical improvement there was a decrease in the titre of the lysozyme found in the stool

Sammons (1951) however suggests that the high titres usually present in ulcerative colitis are the result of lysis of the pus cells that are found in abundance in the stools of patients suffering from the condition and that it is therefore the presence of secondary infection after the colitis has been established

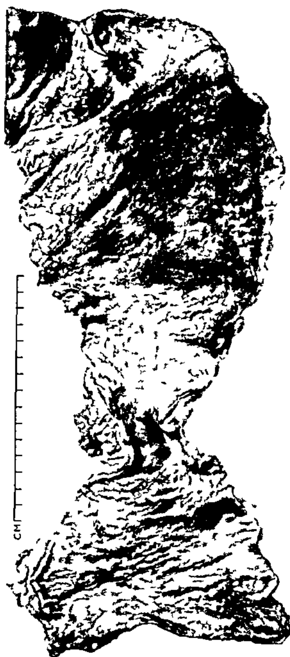


Fig 111
Carcinoma of the pelvic colon occurring in the association with a strictured area of the large intestine in a case of long standing ulcerative colitis

her little inconvenience and which have been aggravated from time to time by emotional upsets by pregnancies by other illnesses or by dietetic indiscretions Although investigation may reveal that the whole of the colon is affected there is little deterioration in well being and general health and interference with the patient's activities is minimal



Fig 112

Representative areas of the caecum the transverse and the descending portions of the colon from a case of fulminating ulcerative colitis The large perforation in the transverse colon was partially sealed by omentum but leakage had occurred with resulting general peritonitis Ileostomy and subtotal colectomy was performed in one stage and the patient recovered

There are various degrees of the disease between these two extremes An **acute type** is recognisable in which although the progress of the illness is less rapid than in the fulminating variety it may be of sufficient severity to reduce the patient to a starved emaciated individual of the Belsen type within a few months The **chronic case** may cease to be mild as it progresses over months and years and instead may be associated with such loss of appetite weight and well being and such anaemia and low grade toxaemia that the patient is reduced to the state of a chronic invalid unable to take part in any occupational or social activity

that produces the enzyme and not the enzyme that is productive of the initial pathology He points out that if the stools are rendered sterile by administration of antibiotics the lysozyme titres of the faeces diminish side by side with the fall in the number of pus cells present in the evacuations although no signs of great clinical improvement are present

Sammons isolated another enzyme mucinase from the stools in ulcerative colitis The presence of this seemed independent of the amount of pus associated with the faeces and uninfluenced by the administration of antibiotics and Sammons suggested that it may play a part in the aetiology of the disease It has the power of destroying mucus and thereby the natural means of protection of the lining cells of the large intestine The enzyme is not found in the normal stool or in the discharge from an ileostomy but in ulcerative colitis it is present in very high titres

Such a theory of the causation of ulcerative colitis is an attractive one but much further work into the origin of the enzyme and its absence or presence in other pathological conditions of the intestine remains to be done before it can be accepted as proven

Sex and Age Incidence

Both sexes seem equally affected Although the commencement of the disease most commonly occurs between the ages of twenty and forty it can occur in children and at the other extreme of life Jackman Bargen and Helmholz (1940) reported on ninety five cases of ulcerative colitis in children below the age of fifteen including twelve patients under the age of six Spriggs (1934) and Willard Pessel Hundley and Bockus (1938) are amongst those reporting the disease in the elderly

CLINICAL TYPES OF THE DISEASE

These vary from the extremes of the fulminating to the mild chronic condition In the **fulminating type** the disease is acute in onset Associated with the passage of large quantities of blood and pus and frequency of bowel action is a toxaemia of the severest degree The patient runs a hectic temperature with a rapid pulse and as a result of excessive fluid loss dehydration is usually very apparent Severe anaemia is present and the loss of appetite aggravates the rapid loss of weight accompanying the disease Abdominal pain is marked The progress of the ulceration in the bowel wall may be rapid and before the thinned areas can be isolated by adhesions one or more large perforations may ensue with resulting general peritonitis (Fig 112) In other cases the disease can end fatally although perforation has not occurred *The mortality rate of this type of ulcerative colitis is very high* though occasionally the disease subsides or else passes into a chronic stage

In the **mild chronic condition** the patient may have noticed the passage of blood and discharge for many years symptoms which have caused him or



Fig 113
X ray appearances of a patient with ulcerative colitis The lack of haustrations and the appearance of a lifeless inert tube are characteristic



Fig 114
X ray appearances of a patient with ulcerative colitis and gross pseudopolypoid formation The irregular stippled appearances of the colon are due to the multiple minute filling defects caused by their presence

A further clinical type is the **recurring case** in which acute exacerbations often necessitating admission to hospital interrupt the otherwise mild course of the disease and in others the anaemia *resulting from the constant haemorrhage* may be the predominant feature of the disease

INVESTIGATIONS

Sigmoidoscopy and barium enema X ray are necessary investigations The diseased condition of the bowel wall make it essential that the former examination shall be carried out with gentleness as perforation of the pelvic colon by pressure on its wall from the examining sigmoidoscope is a very definite danger Endeavours to insert the instrument to its full length should not be made if the colon fails to dilate with minimal air distension and the examiner must rest content with an examination of the lower reaches of the bowel In other cases blood stained mucopus running down from above may also interrupt the insertion of the instrument by obscuring the lumen of the colon which must be constantly under vision during instrumentation

Sigmoidoscopy in cases of ulcerative colitis is often painful and except in the mild cases and those in which the severity of the condition makes anaesthesia undesirable if it can be avoided we prefer to carry out this investigation under an anaesthetic

SIGMOIDOSCOPIC APPEARANCES In the early and milder stages of the disease the mucosa appears more glistening than normal and there are areas of submucosal haemorrhage Later it has a granular and swollen appearance and the slightest pressure by the sigmoidoscope or by a swab produces persistent haemorrhage At this stage purulent discharge may be present sometimes pouring down from above and preventing the onward passage of the sigmoidoscope As the disease progresses definite ulcers are visible and *the mucosa around these is oedematous and undermined or projecting* into the lumen of the bowel as pseudopolyps In the later stages the mucosa may be almost completely absent It is at this stage that a full sigmoidoscopic *examination is likely to be impossible* as not only is the vision obscured by the constant discharge from above but the thickened wall of the lower colon will now no longer distend to permit the passage of the instrument

In the chronic forms of the disease a localised stricture may be seen and as this is approached the sigmoidoscope feels gripped by the less extensive fibrosis lower down Such cases are possible subjects for the development of cancer

X RAY APPEARANCES The barium enema X ray will reveal characteristic changes although these lag behind those seen on sigmoidoscopy Haustration is lost and the appearances are those of a lifeless tube which fails to distend as the barium is *instilled into the bowel (Fig 113) If there is marked* pseudopolyp formation the outline of the colon is irregular and shaggy (Fig 114) Stricture formation or extension of the disease into the ileum will also be revealed by *this examination*

the possibility that in certain selected cases rectal function could be retained and this possibility is discussed below but it can only be considered in those cases where the changes in the rectum have not proceeded to such a stage that contraction and fibrosis is marked From this point of view alone frequent sigmoidoscopy by the surgeon is necessary in order that the local as well as the general response of the patient to medical treatment can be assessed and if in spite of constitutional improvement the ulceration of the rectal mucosa shows no improvement operation should be advised

With these general observations in mind the indications for operation are detailed below and in about 20 per cent of cases operation will be necessary According to Cattell and Sachs 166 or 26 per cent of 630 patients required operation and in Bacon and Trimpi s (1950) series 23 or 19 per cent underwent operative treatment

1 **The Chronic Cases** A large pencentage of those in whom operative treatment is indicated fall into this category The disease may have been present for several years—years often interspersed with hospital treatment Latterly a steady decline of the patient s general health has occurred Constant diarrhoea disturbs his rest continuous slight blood loss results in anaemia and the associated toxaemia results in periodic febrile attacks and an ever present lack of energy and loss of weight and appetite In addition months and even years of absence from work are an economic factor that favours operative treatment



Fig 116 The same patient five months later

2 **The Acute Case Not Responding to Treatment** In this type of case medical treatment fails to halt the steady deterioration of the patient Continued the patient progresses to emaciation and it is before such a state is arrived at that operation should be undertaken

3 **Uncontrollable Haemorrhage** In most cases the haemorrhage associated with ulcerative colitis can be controlled by iron therapy vitamin therapy and periodic transfusions and as the patient recovers the need for these gradually ceases Sometimes however the haemorrhage is so constant and severe that repeated transfusions of blood fail to arrest the decline in the blood picture or even to maintain it at a reasonable level Operative treatment will remove the source of bleeding

4 **The Fulminating Case** If there is no improvement in the patient s general condition with a few days of medical treatment or if there are signs

INDICATIONS FOR OPERATION

It is not uncommon for operation to be advised only after prolonged medical treatment to which the patient has failed to respond with the result that an emaciated individual is offered as a candidate for surgery (Figs 115 116) The operative mortality of any operation on such



FIG 115
The emaciated Belsen type of individual in ulcerative colitis soon after the formation of an ileostomy

patients is high but if the disease is regarded as one in which the responsibility for its cure is shared by the closest co operation between the physician and surgeon few patients will reach such advanced stages of the condition before operation is undertaken

There can be of course no doubt that except in the fulminating case medical treatment must be well tried before recourse to surgery is contemplated but in those cases where there is a decline in the patient s condition in spite of this the day to-day observation of the patient alone can decide the time when such treatment must be advised Every physician is acquainted with the case which after a period of deterioration finally responds but his responsibility as well as that of his surgical colleague is not to allow the deterioration to reach such a point that if operation is then undertaken it will influence its risks The surgeon who has seen the patient from an early stage in his illness is therefore better equipped to form a judgment on the optimum time for operation than if he is called for consultation weeks or months after the commencement of treatment

A reason for the delay in seeking a surgical opinion is the physician s natural hesitation to advise an operation the end result of which is a permanent ileostomy and the patient s reluctance to consent to such a procedure until his illness has become desperate Such delay would be avoided if there was

Much of modern surgical thought advises that in addition to the excision of the colon the rectum should be removed as well (Brooke 1953 Cattell 1953 Gabriel) This advice is given on arguments similar to those used in recommending the excision of the colon

We however are not in agreement with the necessity of excision of the rectum in all cases of ulcerative colitis and have concerned ourselves with the possibility of its retention and of restoring continuity of the intestinal track by anastomosing the ileum to this segment of the large intestine This possibility is now discussed

THE POSSIBILITY OF RETENTION OF THE RECTUM AND OF RESTORATION OF CONTINUITY OF THE BOWEL IN SELECTED CASES

Although modern improvements of ileostomy bag design have relieved an ileostomy of some of its terrors it is idle to pretend that the prospect of its permanency does not bring dismay to many Many patients upon whom an ileostomy is contemplated or performed are in their youth or early married life and to such the prospect that they face seems an overwhelming disaster Apart from the natural distaste that the alteration of the normal channel of evacuation evokes periodic leakages occur even from the most skilfully designed ileostomy appliance use by the most intelligent of patients Distressing embarrassments due to faecal soiling of the personal clothes or of the bed linen are common and are an added burden that the patient has to bear

Moreover the establishment of an ileostomy is not without mortality and the morbidity following its formation is considerable It therefore seems that the rectum should not be sacrificed as a routine in every case unless the possibility of its retention has been excluded absolutely

The possibility of retaining the rectum depends on the following questions

I Are the changes in the rectum in ulcerative colitis irreversible, or are they capable of resolution? In the presence of fistula formation peri rectal suppuration stricture or multiple adenomata no resolution can be expected and no attempt to salvage the rectum should be contemplated There are however many cases in which operation will be required for the cure of the patient where these advanced changes are not present In such it is likely that resolution can occur The evidence upon which we base our opinion for this view is as follows

Firstly most surgeons have sigmoidoscoped patients prior to the commencement of medical treatment and have recorded the gross pathological changes seen and have noted the resolution of these changes in the rectal mucosa after a period of such treatment Often severe inflammatory change persists at higher levels although this too may have been alleviated The initial changes observed are frequently indistinguishable from those seen in

of any decline during that period operation which consists of a subtotal colectomy and the formation of an ileostomy must be undertaken The dangers of perforation in such cases are so great that a lesser risk is accepted if the patient is operated upon

5 **Complications of the Disease** Remote complications are many Arthritis is common and often associated as Bargen pointed out with erythema nodosum although the latter may be present on its own (Elitzac and Wilderman 1941 Jackman *et alia*) Spreading skin ulceration as reported by Butler (1948) Leishman (1949) and Corbett (1952) purpuric haemorrhages buccal ulceration conjunctivitis described by Rice Oxley and Truelove (1950) or pyodermia are all complications that are unlikely to respond to treatment until their cause—the diseased colon—has been removed Local complications such as perforation pericolic abscess formation intestinal obstruction or peri rectal suppuration and fistulae will also require operation for their relief

6 ***Pre malignant Changes*** *The possibility of carcinomatous change in* association with stricture formation or the presence of true multiple adenomata has been emphasised and in the presence of these complications *operation must be undertaken Cancer formation in association with a stricture* is not readily recognisable and its macroscopic appearances bear no resemblance to the carcinomatous tumour found in an otherwise normal bowel *Indeed it may only be on microscopic examination of the strictured area* after colectomy has been undertaken that the malignant change is identified and by that time the disease often of an anaplastic type may have spread widely

OPERATIVE TREATMENT

General Considerations

Save in the fulminating case and in some of those with uncontrollable haemorrhage the improvement following the formation of ileostomy is usually dramatic The emaciated patient puts on weight rapidly and the signs of toxaemia disappear Remote complications too may resolve although they may persist to a lesser degree In fact it may be difficult to persuade a patient to undergo a further operation for the removal of the whole of the large bowel when he is feeling in such good health Yet the retention of the diseased colon is a potential danger in that periodic haemorrhage and purulent discharge may still be a source of chronic anaemia and toxic absorption and as emphasised by Thorlackson (1949) all the features of fulminating colitis can occur despite the presence of an ileostomy Also the possibility that cancerous change may develop in a *strictured area of the retained colon* is an ever present one and complications such as a pericolic abscess may persist or recur as a consequence of its continued presence After satisfactory recovery therefore *it is generally agreed that the excision should be under* taken

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V Should the inflammation in the rectal mucosa regress, is the condition likely to recur?

Only a long follow up can give the answer to this question Ileo rectal anastomosis as opposed to anastomosis of the ileum to the pelvic colon is a recent conception of treatment and the follow up period is as yet therefore short Nevertheless in thirty cases in which the operation has been performed at the Gordon Hospital without operative mortality no case has presented so far in which a recurrence of acute inflammation has suggested that an ileo stomy would be necessary In three cases resolution of the inflammation in the rectal mucosa has not as yet taken place but these patients have remained constitutionally well and no further operation has been undertaken

Conclusion We consider on these grounds that in many cases instead of instituting an ileostomy and subsequently excising the colon and the rectum an effort should be made to preserve the latter anastomosing this to the ileum Should excision of the rectum be necessary in some cases at a future date nothing will have been lost by this effort to preserve it The patient will have been subjected to no additional hazardous operative procedure The excision of the rectum and the formation of an ileostomy would present no surgical difficulties Ileostomy will then have been reserved only for those cases in which it is an essential and it will not have been instituted in those patients in whom it could have been avoided Of the cases referred to above none has so far come to this final stage

In the operation devised by Devine and Devine to retain rectal function the terminal ileum is divided and the distal free end is exteriorised The proximal end of the ileum is sutured to the lower pelvic colon to form a double barrelled approximation of these two regions of the bowel The pelvic colon is then divided above the suture line and all three ends of the intestine are brought out on to the surface of the abdomen Several weeks later continuity between the ileum and the distal colon is established by crushing their adjacent walls with an enterotome and finally the colon is resected

This method of anastomosis does not avoid an ileostomy although this is but temporary but re establishing bowel continuity by crushing the thick ened and inflamed wall of the colon would seem to be fraught with the danger of leakage and of local or spreading intraperitoneal infection Moreover in order to effect a double barrelled anastomosis with exteriorisation it must of necessity be carried out through the pelvic colon although in its lowest part This region of the bowel is often that most severely affected by the disease and it would seem preferable to carry out the anastomosis at a still lower level Nevertheless Devine and Devine have reported good results with this opera tion and Corbett (1952) working along similar lines has also expressed satis faction with the procedure in selected cases Gabriel on the contrary has had to reconstitute the ileostomy in four of six cases upon whom he performed this operation on account of complications associated with it

patients who have failed to respond to medical treatment and who have been referred for operation

Secondly in certain cases sigmoidoscopy has revealed such extensive changes that we have expressed the opinion that resolution was impossible without operation Yet at the end of several months of medical treatment the appearances at sigmoidoscopy have returned to near normal

Thirdly in many cases who continue well under a medical regime of treatment the acuteness of the inflammatory process in the rectal mucosa has largely subsided although resolution may not be complete

Fourthly other authors have recorded resolution in inflammatory change associated with ulcerative colitis Felson and Wolarsky have noted the disappearance of pseudopolypi and the re-epithelialisation of ulcerated areas when this complication has been present Devine and Devine (1948) recorded resolution following excision of most of the colon and a hook up operation

Finally in our own experience apparent complete resolution has taken place in some of our cases following colectomy and ileo rectal anastomosis and in others the inflammatory changes have regressed remarkably If some abnormal enzyme is the cause of the disease and if it is produced at a level above the rectum the removal of its source by excision of the colon would explain why the rectal mucosa subsequently improves Such a supposition is hypothetical but that resolution can and does occur in some cases is undoubtedly true

II Is the rectum or anal canal adversely affected by the presence therein of ileal content?

Our experience of anastomosis of the ileum to the anal canal for other conditions (Aylett 1951 1952) and of its anastomosis to the rectum in certain cases of multiple carcinoma of the colon provides sufficient evidence that no ill effects result from this type of anastomosis due to any proteolytic enzymes in the small intestine

III Will frequency of bowel action following a hook up operation constitute an intolerable disability to the patient's life, and would he not be better off on this score alone with an ileostomy?

The most successful of our cases are having their bowels open three times in the twenty four hours Usually however the bowel actions number between six and eight and the patient may have to get up once in the night Those of the patients who have had an ileostomy before the hook up operation have no doubt whatsoever as to which method of evacuation they prefer and the frequency troubles them but little

IV Following an ileo rectal anastomosis do the patients put on weight and return to such good physical health as following an ileostomy and total excision of the large intestine?

In our experience the immediate recovery of these patients and their rapid return to good physique is similar in both types of operation

Two stab wounds separated by a bridge of skin about 2 cm wide are made low down in the left iliac fossa and after division of the colon about 4 cm above the anastomosis the ends are passed one through each incision (Figs 117D 118) The peritoneum is sutured accurately to the sero-muscular coat of the emerging limbs of the large bowel and the abdomen is closed

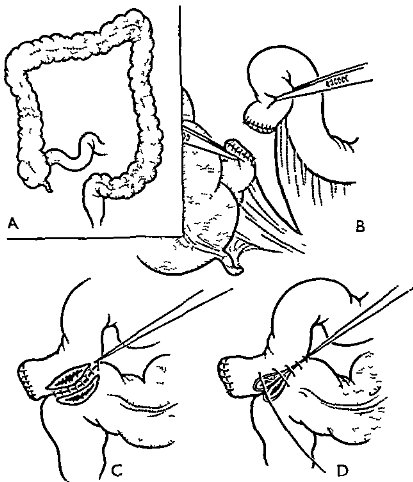


FIG 117
Ileo rectal anastomosis and colectomy for ulcerative colitis stage I
(a) The stippled area indicates the extent of the bowel to be excised at a subsequent stage of the operation
(b) Division of the terminal ileum and closure of both ends
(c) Approximation of the ileum to the upper rectum by interrupted thread sutures
(d) The completion of the anastomosis

The patient is thus left with an end of the colon a little above the rectal anastomosis opening onto the surface of the abdomen (Fig 119) This provides a safety valve effect so that any pressure the result of accumulation of intestinal content or flatus in the rectum which might be sufficient to break down the anastomosis is prevented from developing as the contents will discharge

We consider that the method of anastomosis which we have adopted avoids the disadvantages of the Devine operation and the operative technique in dealing with these cases of ulcerative colitis in which the rectum is to be retained is now detailed

OPERATIVE TECHNIQUE OF ILEO RECTAL ANASTOMOSIS WITH COLECTOMY

Most cases will have been built up with a high protein diet vitamin therapy and intravenous blood and saline transfusion in so far as is possible during their period of medical care before operation is decided upon Bowel sterilisants however must be given in the days immediately preceding operation

The abdomen is opened through a left paramedian incision The ileum and the adjacent mesentery a few centimetres from the ileo-caecal valve are cut across between clamps and the open ends of the bowel are closed (Fig 117A B) The proximal ileum is then approximated to the anterior wall of the uppermost part of the rectum and pelvi rectal region by means of a series of closely placed sero muscular interrupted sutures of No 80 linen thread for a length of about 3 cm (Fig 117C) Far more accurate apposition of the oedematous wall of the colon to that of the small intestine can be achieved with this suture material than if catgut is used and the interrupted sutures too offer greater security Non-crushing clamps are then applied to the colon and to the small intestine above this suture line and after opening the approximated regions of the bowel they are anastomosed (Fig 117C and D) A continuous No 1 intestinal catgut suture is used to complete the inner layer of the anastomosis the needle passing through all three layers of both adjacent edges of gut wall A Connell inversion stitch is used for the anterior layer The sero-muscular layers of the small and large intestines are drawn over the latter suture line again by interrupted linen thread sutures and finally the anastomosis is reinforced by a third suture layer

The surgeon in consultation with the anaesthetist now decides whether the condition of the patient is sufficiently good to allow the excision of the colon to be proceeded with Should this be adequate—and with increasing experience of the operation more will fall into this category—the excision is carried out along the lines to be indicated subsequently In such cases the colon is cut across at the pelvi rectal junction and the open end which remains is exteriorised usually through the lower end of the main incision This acts as a safety valve in the manner described below We have recently made a practice of closing two thirds of this open end so that the faecal discharge therefrom is reduced whilst its safety valve effect is still retained

If it is considered desirable in view of the patient s condition to delay the colectomy to a future occasion the operation is continued in the following manner

from the skin and the muscle layers of the abdominal wall through which it is passing but its attachment to the peritoneum is not separated A two layer closure of the open end is then effected and the muscles and skin are sutured over this a corrugated drainage tube being passed down to the closed bowel end Should the suture line leak in the post-operative period there is no danger of a spill of faecal content into the peritoneal cavity as the closure is extraperitoneal Any leakage therefore will discharge on to the abdominal surface

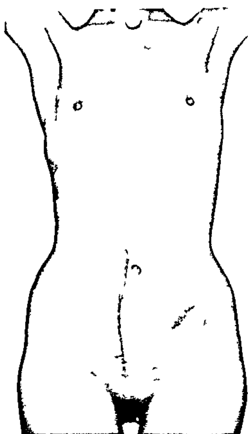
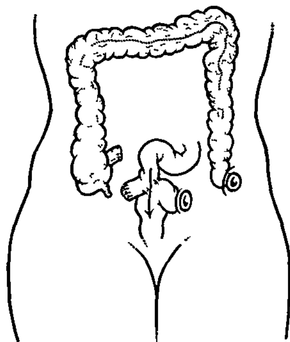


FIG 1.0
Ileo pelvi rectal anastomosis and colectomy stage II The safety valve colostomy closed In this patient the colectomy was performed at the same time as the ileo pelvi rectal anastomosis so that only one scar in the left iliac fossa is present

The colectomy is usually undertaken some three weeks after the closure of the safety valve If at the time of the original laparotomy signs of pericolitis with inflammatory adherence between the colon and the surrounding structures were found this final stage should be delayed for about three months At the end of this period the inflammation will have settled and the adhesions will be minimal so that the affected region of the colon can be dissected without the risk of injury to adjacent structures

The emerging open end of the colon is dissected free from the abdominal wall and is closed by an overrunning suture After fresh towels have been re applied and the surgeon and his assistants have scrubbed up afresh the abdomen is opened either through the old incision or through a fresh paramedian one

The lateral peritoneal reflections of the right and left sides of the colon are incised as far up as the flexures and the bowel is mobilised In ulcerative colitis the great omentum is usually thickened and adherent to the transverse colon and it will be found impossible to separate the two It is therefore necessary to divide the omentum from the greater curvature of the stomach and this incision between it and the transverse colon will meet with the incisions in the peritoneum at the level of the flexures The free distal invaginated end of the small intestine is identified and its mesenteric attachment is cut between clamps The colon is then ready for removal and after each ureter has been identified it is divided from its posterior attachments between



through the colostomy before sufficient tension to produce damage has been built up In actual practice although considerable quantities of flatus are passed the amount of ileal content that escapes on to the abdominal surface is not great and has not been sufficient to produce excoriation of the skin Neverth less we feel that the absence of any leakage in our cases at the anastomotic site has been due to the safety valve effect of this colostomy and that an intraperitoneal anastomosis carried out through grossly diseased bowel wall without this device might be accompanied with greater danger of leakage The idea of decompression of the bowel by this method was first introduced by Muir (1947) who employed the technique when carrying out a right hemicolectomy It is fair to state however that some of my colleagues at the Gordon Hospital consider that an anastomosis can be achieved with safety without institut ing this colostomy



FIG 118
Diagram to show the completion of the first stage of the operation

Closure of the safety valve some three to four weeks after the initial operation is the next step in the planned treatment of the condition (Fig 120) By this time the anas tomosis will have united soundly and there is then no need for the safety valve effect Moreover it is best that this should be closed before the abdomen is re-opened to remove the colon as the risk of faecal con tamination of the abdominal wound is thereby reduced

The bowel is dissected away



FIG 119
The abdomen of a patient aged ten years at the completion of stage I of the operation

is thus raised from the abdominal wall rather than if it is fashioned to be flush with the surface

According to Warren the ileum should not be sutured to the layers of the abdominal wall through which it passes for fear that the sutures might penetrate into the lumen of the bowel with subsequent fistula formation We consider however that safer fixation of the emerging ileum can be achieved by accurate suture of the peritoneum to the sero muscular layer of the ileal wall and with careful insertion of the stitches the risk of penetration into the bowel lumen is not a real one Having thus secured the ileostomy further fixation of its wall by suture to the muscle layers of the abdomen is unnecessary and even undesirable as stricture formation around its orifice is then more prone to develop

When the ileostomy is brought out through the rectus muscle a very large gutter remains between it and the later abdominal wall so spacious that obstruction is most unlikely to develop if the coils of the small intestine fall into it Its obliteration by suture of the lateral peritoneum to the emerging ileum is therefore unnecessary and more likely to give rise to obstruction than to prevent it If however the ileostomy has been exteriorised in the right iliac fossa the space then left is a narrow one and this should be obliterated as recommended by Hardy Brooke and Hawkins (1949) by suture of the mesentery of the ileum to the peritoneum of the lateral abdominal wall

Exteriorisation of both ends of the ileum the more distal being brought out through a stab incision in the right iliac fossa is essential in the rarer case in which the disease has involved the terminal part of the small intestine In these cases the bowel is severed through healthy tissue at a line several centi metres proximal to the macroscopic limit of the spread of the condition so that a length of intestine perhaps 15 cm or more remains in continuity with the caecum The closure of the free end of this followed by its replacement inside the general peritoneal cavity is not a safe procedure as leakage from the site of suture may occur It is also unsafe to resect the diseased part of the small intestine and to close the remaining stump as the sutures invaginat ing this are likely to cut out in view of the inflamed and oedematous nature of its wall When the two ends have been exteriorised a V will be left between the peritoneum of the anterior abdominal wall and the mesentery Into this a loop of intestine can easily insinuate itself with resulting obstruction and it must therefore be obliterated by suturing the cut edges of the mesentery to the peritoneum of the anterior abdominal wall

Following closure of the abdomen the end of the ileostomy is turned back on itself and its free end is sutured to the skin margin If direct union between mucosa and skin edge is obtained there is little likelihood of fibrosis with consequent obstruction of the opening of the ileostomy developing in this region Although in the post-operative stage some of these sutures may cut out so that some healing by granulation tissue may occur the manoeuvre is well worth the few minutes that it takes to perform

clamps placed close to the bowel margin Very little raw area is left at the completion of the operation and no reperitonealisation is required Following this the abdomen is closed but if there is much ooze drainage is advisable for forty-eight hours

ILEOSTOMY TOTAL COLECTOMY AND EXCISION OF THE RECTUM

The indications which we accept for this operation have been noted and it is planned to be carried out usually in three stages Firstly the ileostomy secondly the subtotal colectomy and lastly the excision of the rectum and the remaining segment of the colon by a combined abdomino perineal approach

In forming an ileostomy, the selection of the site at which it is to be exteriorised is important and this is mainly determined by the ease with which an ileostomy bag of modern design can be applied at the various points in the lower right segment of the abdominal wall If for example the opening is made too near to the anterior superior iliac spine then the bag cannot be affixed and if the ileostomy although well away from any bony prominences is too low then the appliance tends to ride up when sitting down Cattell (1944) advised that the ideal position was one 6 cm below the umbilicus and 3 cm away from the mid line and this is a position similar to that favoured by Dennis (1945) Gabriel and Counsell and Goligher (1952) however advise a position closer to the umbilicus Either site works admirably

All surgeons are now agreed that a terminal ileostomy is preferable to one made at the apex of a loop as prolapse is a more common complication of the latter type Similar agreement does not exist with regard to whether the distal end of the terminal ileum should be exteriorised or whether it is safe to invaginate it into the caecum The theoretical consideration that back pressure may cause leakage through this stump if it is invaginated seems to be unfounded in practice Moreover the chance of post ileostomy obstructions the result of loops of small intestine insinuating themselves between the emerging loops of bowel or between them and the lateral abdominal wall in spite of efforts to obliterate the spaces is greater if two rather than one limb of intestine is exteriorised Cave and Thompson and Brooke however still favour exteriorisation of both ileal ends but Gabriel and Warren (1951) are amongst those who advise closure and invagination of the distal stump

The abdomen is opened through a right rectus splitting incision The *terminal ileum is identified and if free of any backward extension of the disease* it and its mesentery the latter for a depth of about 4 cm are cut across between clamps The line of section across the ileum leaves a distal stump 3 cm long and this is closed following which it is invaginated into the caecum

The proximal end of the ileum is exteriorised at the upper end of the wound so that it projects beyond the skin for a distance of 2 cm The discharges from the ileostomy are more readily collected by an ileostomy bag if its end

is thus raised from the abdominal wall rather than if it is fashioned to be flush with the surface

According to Warren the ileum should not be sutured to the layers of the abdominal wall through which it passes for fear that the sutures might penetrate into the lumen of the bowel with subsequent fistula formation We consider however that safer fixation of the emerging ileum can be achieved by accurate suture of the peritoneum to the sero muscular layer of the ileal wall and with careful insertion of the stitches the risk of penetration into the bowel lumen is not a real one Having thus secured the ileostomy further fixation of its wall by suture to the muscle layers of the abdomen is unnecessary and even undesirable as stricture formation around its orifice is then more prone to develop

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The second stage of subtotal colectomy is carried out in the manner described in the conservative procedure with the difference that it is at this operation that the distal end of the pelvic colon is brought on to the skin surface



FIG 121
Post operative photograph of the patient the specimen from whom is shown in Fig 112 Following colectomy the terminal ileum was exteriorised as an ileostomy and the cut distal end of the pelvic colon as a colostomy

The final abdomino perineal excision of the rectum and the residuum of the colon follows, in the main the technique laid down by Miles for removal of these regions This has been described previously It differs only in that the colostomy has first to be dissected from the anterior abdominal wall and that the dissection can be kept close to the pelvic and rectal walls as no removal of the area of lymphatic drainage is required

Treatment of the Fulminating Case

In the fulminating cases total colectomy must be carried out as this alone offers the patient a chance of recovery when medical treatment fails to bring about an early improvement It is insufficient to carry out a simple

ileostomy as the ulcerated and thinned bowel may well perforate in the post operative period even though the faecal flow has been diverted Moreover the source of the gross toxaemia remains and its continued presence is likely to cause the patient s death even should he escape the fatal danger of a perforation of the colon

Where perforation has already occurred the treatment is similar It is not sufficient to exteriorise the ruptured loop of colon as apart from leaving *in situ* the rest of the diseased bowel productive of the toxaemia of the disease other areas of the colon may be on the point of perforation and these may rupture in the first few post operative days

Even if an anastomosis between ileum and rectum is contemplated this is not performed at the time of the colectomy as the operation time must be reduced to an absolute minimum The free ends of the ileum and the distal colon are therefore exteriorised following the colectomy (Fig 121) and recon struction is undertaken when the patient has recovered

Treatment of Haemorrhage Uncontrolled by Conservative Methods

In uncontrollable haemorrhage a similar method of treatment may be necessary as as noted by Cave and Thompson (1941) a simple ileostomy is not always effective in controlling the bleeding

POST-OPERATIVE CARE AND COMPLICATIONS

A Following the Conservative Operation

1 **Fluid and Electrolyte Replacement** Intravenous fluid and electrolyte replacement and blood transfusion where required is given The safety valve usually discharges about the third post-operative day Soon after this the patient commences to have bowel actions through the normal channel when feeding by mouth is started It is preferable to continue the intravenous glucose saline for a further two or three days as during this time evacuations are extremely fluid and depletion of the tissues may result if the drip is dis continued too soon

2 **Management of the Safety Valve** After a period of a week or so the discharges from the safety valve lessen and of their own accord tend to become semi solid but this process can be hastened at an early stage by giving the patient Isogel 1 teaspoonful three times a day and Edifas in half these doses The latter is often best taken with bread and butter Both of these substances are water absorbents and therefore increase the bulk and solidity of the stool Probanthine 15 mg three times a day is also of value in reducing the motility of the intestine

As soon as the safety valve starts to discharge a disposable ileostomy bag is fitted over it These bags consist of hollow cylinders of cellophane closed above and below by zinc oxide strapping The upper part of the wall which is to be in contact with the abdomen contains a hole which fits over the ileostomy or in this case the safety valve Adhesive is incorporated in the

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re sealed with zinc oxide strapping and by this device it needs replacement only about twice in the twenty four hours

The hole in the ileostomy bag fits fairly closely around the small intestine projecting from the abdominal wall but in spite of this some excoriation of the skin is common In such cases it is best to apply to the skin some Ung galli c̄ opii or aluminium paint and to surround the ileostomy with a small hollow cylinder of gauze filled with plasmon oats The latter adsorbs the fluid of the intestinal content and undergoing digestion itself partially prevents the skin from sharing a similar fate An old type ileostomy cup attached by a belt and connected to a rubber bag is used to cover the ileostomy and to collect its discharge After a period of three or four weeks when the composition of the ileal content has become semi solid the skin ceases to become excoriated even though contaminated with the discharge and the patient is taught the use of a modern appliance

3 **Obstruction** This may be due to an intraperitoneal cause but more often it seems to result from some ill understood interruption of the peristaltic wave as it reaches the intramural portion of the ileum Counsell and Goligher experienced this complication in twenty six of sixty cases and Warren and his co workers noted it in 130 of their 210 ileostomies These obstructive episodes as the former authors refer to them commence after initial satis factory ileostomy evacuations The patient complains of severe intestinal colic and vomiting may follow Within a short period of time the general condition starts to decline and the pulse rate increases On examination of the abdomen there is generalised distension and often tenderness about the ileostomy The surgeon observing such a case for the first time may well suppose that some intraperitoneal obstruction exists and his opinion is supported by the fact that a finger may often be passed into the ileostomy without difficulty If such cases are operated upon a dilated ileum is found the dilation extending as far as the intramural portion of the small intestine but no organic cause for this condition is discoverable

Though no obvious stricture is present it is apparent that for some reason difficult to explain the contractions of the ileum are insufficient to expel the faeces through its intramural part The condition resolves if a rectal tube is passed through the ileostomy for a distance of some 10 cm and its passage is sometimes accompanied by an almost explosive discharge of ileal content The obstruction is likely to recur and the tube may have to be passed several times in the twenty four hours for a number of days but eventually the con dition settles though for several weeks periodic minor episodes are common It would be desirable to keep the tube in the ileum until the acute stage has resolved but this is impracticable as it is usually expelled within a short period of time by the contractions of the ileum Where much distension is present or if vomiting has taken place gastric suction and fluid and electrolyte replace ment will be required

wall of the bag in this region so it is readily fixed to the skin surrounding the exteriorised bowel

The discharge from these safety valves has been so slight that one of these bags the capacity of which is not great lasts thirty six to forty-eight hours Excoriation of the skin has been absent or so minimal as to present no problem

3 **Post operative Obstruction** Obstruction may develop as a result of oedema at the line of anastomosis between the small intestine and the colon but a tube inserted through the safety valve and manipulated to pass into the ileum will serve to relieve this

Bands and adhesions the result of the operation may of course produce similar symptoms although in our series of cases these causes of obstruction have not been met with Should the symptoms be unrelieved by the insertion of the tube however they must be considered A straight X ray of the abdomen may help by revealing the shadow of an obstructed loop or by showing fluid levels The case should be treated conservatively by intestinal aspiration and fluid replacement and operation undertaken only if this fails to relieve the condition or if there is any evidence of strangulation This will be diagnosed if any localised severe tenderness or rigidity develops in the abdomen or if there is a rise in the pulse rate associated with deterioration of the patient's general condition

4 **Antibiotics** All patients are continued on antibiotics in the first few post-operative days

B FOLLOWING ILEOSTOMY

1 **Fluid, Saline and Protein Balance** Our experience of ileostomies persuades us that many of these patients are far more difficult to keep in fluid and electrolyte balance during the early post-operative period than those patients in whom an anastomosis has been performed Daily checks on the plasma chlorides and potassium values as well as estimations of the haemo-concentration are essential and variations in their value away from the normal limits must be corrected by appropriate intravenous transfusions Commonly such transfusions will need to be prolonged and blood should always be given where the patient s poor condition necessitates their continuation for more than five days in order to replace in some measure the associated protein loss

2 **Management of the Ileostomy** The regime of feeding and the administration of water absorbents is similar to that described in considering the management of the safety valve and with the increase of fluid intake by the mouth and the diminution of the fluid character of the discharge from the ileostomy that given intravenously can be reduced and finally stopped

As soon as the ileostomy starts to act a disposable ileostomy bag is fitted This will naturally fill more rapidly than that applied to the safety valve in the conservative operation but its content can be drained away periodically by cutting away a small strip from its lower end The bag is then

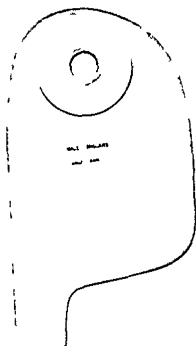


Fig 122
Ileostomy bag supplied by Messrs Salt & Son

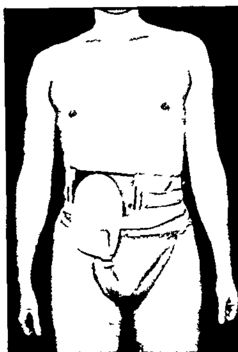


Fig 123
The bag fixed in position

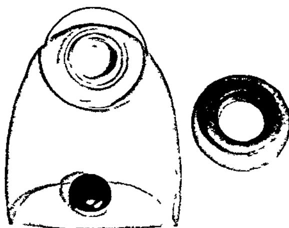


Fig 124
Ileostomy bag and cuffs one of perspex and one of rubber made by Messrs Down Brothers and Mayer & Phelps Ltd

If the obstructive symptoms do not respond rapidly to the treatment detailed above it must be assumed that an organic intraperitoneal cause is present and laparotomy must be undertaken

4 **Prolapse of the Ileostomy** Minor eversions of the ileum through the ileostomy are common and are best controlled by wearing an abdominal belt fitted with a pad that exerts mild pressure over the ileostomy opening Attempts to cure more extensive prolapse by operation are by no means always successful The ileostomy may be dissected out and reformed perhaps after excision of the length of intestine that prolapses at a point in the abdominal wall where the mesentery is more under tension or the mesentery or the ileum may be sutured to the anterior parietal peritoneum In other cases the opening in the wall of the abdomen may be made smaller but it must be admitted that there is no certain cure for the complication

Rarely the prolapsed intestine may become strangulated and urgent resection will be required

5 ***Stenosis of the Muco Cutaneous Junction*** The incidence of this complication is reduced by the suture of the mucosa to the skin at the time of the formation of the ileostomy It occurs in spite of regular digital dilation if *much granulation tissue which is subsequently replaced by fibrosis forms* between the free edges of the skin and of the ileostomy Sometimes the ileostomy is reduced to an aperture that would not admit a pencil yet it still *functions efficiently Only if there are obstructive signs should the rim of* fibrosis be excised and the ileostomy refashioned

6 **Perforation of the Ileostomy** If the ileostomy projects more than about 2 cm from the skin surface small patches of gangrene sometimes develop with resulting perforation of its extramural part Such perforations may also be caused by the friction of an ileostomy bag the mouth of which is too small The latter should be of such a size that a circle of skin is always present between the emerging ileostomy and the adherent bag

Although extramural perforation causes no serious harm the ileal content emerging from the side of the ileostomy *is collected less effectively by a bag* and if there is leakage the perforated ileum must be amputated and the ileostomy refashioned

Rarely the intramural portion of the ileostomy perforates with resulting abscess formation in the subcutaneous tissues of the abdominal wall This will require draining and again the ileostomy will require subsequent *reforming*

Ileostomy Appliances

To the improvement in modern ileostomy bag design the patient owes much of the comparative comfort with which he can bear his disability *The* aim of such appliances is to seal the receiving bag to the skin surrounding the ileostomy so that none of the ileal discharge can leak between the two to produce excoriation or embarrassing *soiling of the clothes*

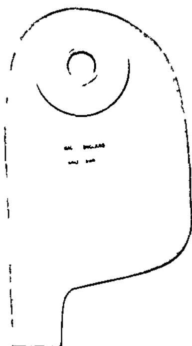


Fig 122
Ileostomy bag supplied by Messrs Salt & Son

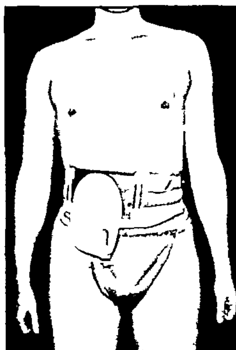


Fig 123
The bag fixed in position

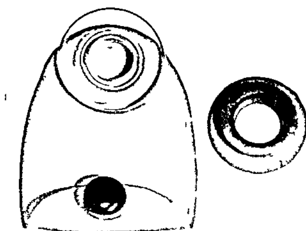


Fig 124
Ileostomy bag and cuffs one of perspex and one of rubber made by Messrs Down Brothers and Mayer & Phelps Ltd

The first of the modern appliances introduced was the Koenig Rutzen bag but this is not available in this country One of similar design however is made by Messrs Salt (Fig 122 123) The hole in this bag which fits around the ileostomy is surrounded by a circular disc To this and to an equal area of skin adjacent to the ileostomy is applied a cement solution which when the bag is in position seals the two together by a watertight union The bag is emptied through a prolongation of its lower part which at other times is kept closed by folding it back on itself and maintaining it in position by a rubber band or clamp

Most patients find it best to remove the bag at the end of twenty four hours the cement union between it and the skin being dissolved with a special solvent and after cleaning the skin to apply a fresh bag The used bag is then thoroughly washed and disinfected to be ready for application on the following day If the appliance is maintained in position for more than twenty four hours it is apt to become disagreeably odiferous

In the bag supplied by Messrs Down Brothers a somewhat different idea is incorporated (Fig 124) A shallow hollow cylinder or cuff flanged at either end and made of rubber or perspex is used to fit over the ileostomy This is kept in contact with the skin by double faced zinc oxide plaster one surface of which adheres to one of the flanges and the other to the skin itself the plaster being suitably perforated to surround the ileostomy

A hole in the receiving rubber bag fits over the flange at the other end of the cuff and the natural elasticity of the former maintains a watertight junction The bag is emptied through a vent controlled by a screw cap which is built into its lower part

The advantage of this bag lies in the fact that it can be detached from the cuff without disturbing the fixity of the latter to the skin The cuff may therefore be left in position for several days without disturbance and fresh bags may be fitted over it as required Skin reactions due to repeated changing of the plaster or in the case of the Salt bag of the cement are less likely to occur

Most patients can be satisfactorily taught the use of one or other of these bags From time to time however patients are encountered in whom skin reactions prevent the use of either of these appliances In such cases one of the older type of collecting bags the receiver of which is maintained in position by an abdominal belt alone must be used

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CHAPTER XIV

OTHER GRANULOMATOUS CONDITIONS OF THE COLON

REGIONAL AND SEGMENTAL COLITIS

GENERAL Considerations Crohn and Berg (1938) drew attention to an ulcerative condition of the colon first recognised by Rankin Bargen and Buie in 1932 which for a prolonged time remained confined to the right side of the colon These authors suggested that the condition commenced in the region of the hepatic flexure and that from this initial site it spread



Fig 125

Part of the small intestine resected from the patient the colon from which is shown in Fig 126 The macroscopic and microscopic appearances are those of Crohn s disease

proximally into the ascending colon and the caecum and distally into the transverse colon They also described a segmental type of the condition in which the diseased area remained localised in other sectors of the large intestine Although both varieties of the disease are likely to spread finally to affect large areas of the colon they remain localised for a considerable time and rarely involve the sigmoid colon In this the disease differs from a typical example of diffuse idiopathic ulcerative colitis

In their description of the pathology of the disease Crohn and Berg recorded its similarity to that of ulcerative colitis but recently Lumb (1951) has described the presence of giant cell *formation* epithelial *proliferation* and lymphatic stasis in certain cases which are the criteria by which Hadfield (1939) recognises Crohn s disease It would thus appear that this form of regional or segmental colitis may on occasions be similar to that disease originally described by Crohn Ginsberg and Oppenheimer (1932) as occurring in the terminal ileum Cases in which a regional ileitis has spread from the terminal ileum to involve the caecum and colon are well known and Colp (1934) and Butler (1953) are amongst the authors describing such conditions In one of our own cases operated upon for sub acute terminal ileitis the transverse colon which at the time of operation was adherent to the diseased small intestine subsequently developed a segmental colitis of similar pathological nature At the time of the second operation for resection of the affected bowel the disease had spread into the descending and upper part of the pelvic colon (Figs 125 126)

The occasional occurrence of epithelial hyperplasia giant cell formation and lymphatic stasis even in diffuse ulcerative colitis inclines Lumb to believe that these different types of ulceration of the colon and terminal ileum are but varying reactions to similar causative factors Brooke and Cooke (1951) and Brooke (1953) on the contrary believe that a right sided colitis is always accompanied by an ileitis that it is secondary to the latter and that it is a separable disease from diffuse ulcerative colitis Our own view is that

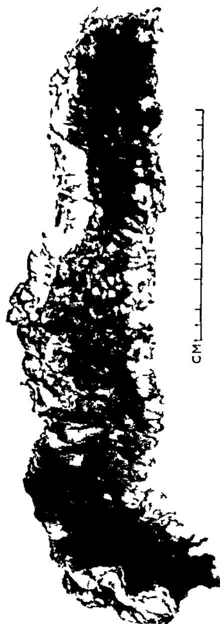


FIG 126

Part of the transverse colon and the left side of the colon from a case of regional colitis The macroscopic and microscopic appearances of the bowel are identical to those of Crohn s disease Eighteen months before the colon was excised *resection of* the terminal ileum had been undertaken for regional ileitis



FIG 127
A barium enema X ray showing a segmental colitis affecting the pelvic colon



FIG 128
A barium enema X ray showing segmental colitis affecting the left side of the colon

all cases of regional or segmental colitis although giving rise to similar symptoms are not due to the same cause In certain cases the close similarity both on inspection of the bowel at the time of operation and on pathological

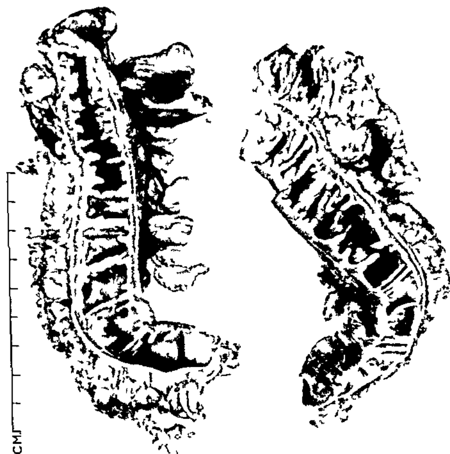


FIG 129

A segment of the pelvic colon affected by regional colitis The wall of the bowel is thickened and inflamed and its lumen narrowed

examination between these cases and those affected with Crohn s disease of the terminal ileum support the view that they are of similar origin The grossly swollen and oedematous meso colon with its fleshy enlarged lymph nodes however are not always present and in such cases the aetiology may well be different and similar to that of ulcerative colitis

Symptoms and Diagnosis The disease commences with intermittent attacks of diarrhoea sometimes accompanied by the obvious passage of blood and mucus Initially these attacks are mild but they increase in severity and

are accompanied by constitutional signs of fever and increased pulse rate loss of appetite and weight and of anaemia and in the female amenorrhoea In some cases cardiac or joint affections may develop

A barium enema will reveal the area of colon affected (Figs 127 128) Sigmoidoscopy usually shows a normal mucosal pattern of the rectum and lower sigmoid colon but blood and purulent material running down from higher reaches of the bowel may suggest the diagnosis

Treatment In view of the tendency of segmental and right sided colitis to spread extensively operation should not be delayed if the patient does not quickly respond to medical treatment At operation the affected area of bowel is excised and continuity re-established by suitable anastomosis (Fig 129) The limits of the excision must however be well wide of the obvious margin of the disease

ACTINOMYCOSIS

This rare infection although usually producing lesions in the ileocaecal region can affect other parts of the colon The intense fibrocytic reaction engendered by the presence of the mycelia gives rise to a mass which unless there is evidence of the disease elsewhere is usually diagnosed as a carcinoma In disease of the caecal region the initial symptoms may have suggested a chronic appendicitis and following removal of this organ multiple fistulae may develop which discharge the typical sulphur grains containing the fungus

Surgical excision is rarely possible and the provision of adequate drainage of loculated pockets of pus is all that can be undertaken Main reliance in the treatment of the disease is placed on high and prolonged doses of penicillin

TUBERCULOSIS

Ulcerative Tuberculosis *of the intestinal track is a fairly common complication of pulmonary infection and although any part of the intestine from the duodenum to the rectum may become involved the disease usually affects the terminal ileum where the lymph follicles are most numerous These lesions are likely to respond to modern methods of medical treatment and only become a surgical problem if obstruction ensues the result either of cicatricial contraction or of adhesive peritonitis producing kinking of the bowel or if the ulcer perforates

Hypertrophic Tuberculosis of the intestine is on the contrary an uncommon condition and Crohn and Yarnis (1940) report in their review of autopsy and resection specimens examined at the Mount Sinai Hospital during the years 1926 to 1938 that they were able to find only four examples of the disease Bockus (1944) comments similarly on the rarity of the condition and could recall but three resections for tuberculous disease of the proximal colon in a period of twenty two years whilst Maxwell (1936) observed only two examples in over 8 000 autopsies A larger series is reported from the Mayo Clinic by Hoon Dockerty and Pemberton fifty-eight proven cases having been seen over the period 1921/1946

It would appear that the disease is more common in this country than in the United States as most surgeons here will have seen more examples over similar periods of time than the very limited number referred to above Lockhart Mummery (1923) reported a series of 100 cases involving the large intestine but it must be appreciated that some of this author s cases may well have been due to a non specific colitis a condition which at the time of the publication was not recognised Today a diagnosis of hypertrophic tuberculosis can only be considered proven if acid fast bacilli can be identified in the excised specimen either in the bowel itself or in the lymph glands draining the area or if a guinea pig innoculation test is positive or if typical tubercles are present



Fig 130
Hypertrophic tuberculosis of the caecum A similar lesion is present in the terminal ileum

This form of tuberculosis is most common between the ages of twenty and forty and females are more often affected than males Although the caecum is most often the site of the disease it may involve any region of the large intestine A pulmonary lesion is absent in some 70 per cent of cases though there may be evidence of other sites of old or active infection such as tuberculous lymph nodes or tuberculous foci in the kidneys or in the bones It is likely that the infection is usually due to the bovine strain of the bacillus introduced into the intestine by drinking contaminated milk although it does occur in cases in which there is absolute evidence that no cow s milk has been consumed

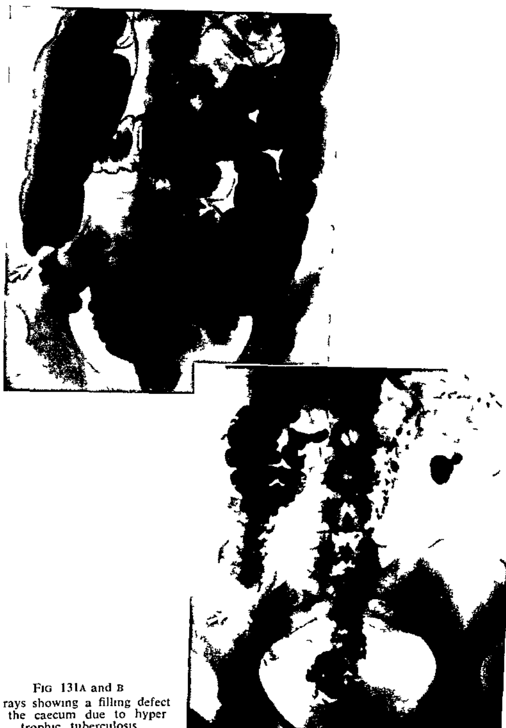


FIG 131A and B
X rays showing a filling defect in the caecum due to hyper trophic tuberculosis

The infecting organisms penetrate the wall of the bowel by being carried through the epithelial lining by phagocytic cells. Thus they reach the submucosa where the initial tubercle formation develops. The disease with its accompanying caseation and fibrosis spreads outwards through the muscle coats of the bowel wall until eventually the visceral peritoneum becomes involved. The hyperplastic reaction results in the formation of a large mass in the portion of the bowel affected and this is increased in size by the adherence to it of the great omentum which becomes similarly thickened (Fig 130). In some cases the lining mucosa of the colon becomes extensively ulcerated but in most it remains intact or but slightly affected.

Symptoms and Signs Patients often complain of increasing constipation associated with abdominal discomfort, colic or distension before noticing actual pain referred to the region of the lesion. These preliminary symptoms may precede an attack of acute or sub acute obstruction associated with nausea and vomiting. Diarrhoea is rarely complained of owing to the minor degree of ulceration of the mucosa that is normally present, and for a similar reason anaemia, if it exists at all, is slight. Constitutional disturbance such as loss of weight and well being, periodic pyrexial attacks or night sweats, are never very marked.

Examination of the abdomen usually reveals a mass which is hard and fixed and which is tender on palpation. There may be some abdominal distension and peristalsis may be visible.

A barium meal or enema X ray will show a filling defect in the affected colon or caecum (Fig 131A and B) which, although it cannot always be differentiated from that due to a carcinoma, is suggestive of a tuberculous lesion when its outline is smooth and regular and when, in the case of a lesion in the caecum, the latter is contracted up towards the hepatic flexure.

Differential Diagnosis It is often impossible to differentiate a tuberculous lesion from a carcinoma although the youth of the patient, a prolonged history of abdominal pain without deterioration of the general condition and the absence of blood in the stool or signs of anaemia may suggest its nature. Nevertheless it is fortunate that both conditions require operation for their cure as, even with an X ray examination, complete certainty of diagnosis is uncommon.

Although an appendicular abscess may occasionally mimic a hypertrophic tuberculosis of the caecum, the former condition is likely to have started with a pyrexial attack, perhaps associated with nausea and vomiting, and is always accompanied by a raised white blood cell count.

From a regional ileitis that has involved the caecum or from a regional colitis of the same cause, differentiation is again difficult. Constitutional symptoms of ill health, fever, anaemia and diarrhoea are far more marked in Crohn's disease and the very elongated string like appearance of the barium in an X ray as it passes through the site of the latter disease in a typical case may help to diagnose the condition. In many cases, however, the final diag

nosis will not be made even at operation and will have to await examination of the excised specimen

Actinomycosis is rare but unless fistulous formations have occurred from which the mycelia can be isolated differential diagnosis may be impossible

Treatment The treatment of hypertrophic tuberculosis is by excision of the affected region of the bowel In disease of the caecum this is best achieved by carrying out a right hemicolectomy but elsewhere in the colon a more local excision is sufficient

If the case has not been seen until obstruction supervenes a preliminary short circuit operation or a colostomy according to the site of the growth will be required to relieve the obstruction The resection of the mass is under taken subsequently Post operative treatment of a sanatorial type combined with antibiosis is advisable after excision has been undertaken

AMOEBIASIS

Surgical Pathology This infection which presents surgical problems of diagnosis and treatment is the result of the ingestion of the cyst form of the protozoal parasite entamoeba histolytica From the cysts the trophozoites develop and proceed to burrow into the mucosal lining of the large intestine where they multiply by fission Although the large intestine is their usual habitat the small intestine may also be involved as Biggam (1930) has emphasised

As a result of the presence of the protozoa in the bowel wall areas of necrosis develop with destruction of the overlying mucosa so that ulceration ensues These ulcers are at first small and are surrounded by a zone of inflam matory tissue Later as the ulcers coalesce and the trophozoites burrow deeper into the wall of the colon large areas of ulceration result the edges of which are overhung by oedematous and inflamed mucosa In an advanced stage of the disease the area of ulceration the bases of which are covered by a dirty slough occupy much of the surface of the colon

In some cases an intense granulomatous reaction accompanies the disease probably the result of a secondary as well as of the initial infection A hard mass is produced and the inflammation spreading through the wall of the bowel gives rise to fixation of the affected part The caecum and pelvi rectal regions are particularly the sites of such lesions and their presence there may well give rise to a mistaken diagnosis of carcinoma

Obstruction of an acute or sub acute type due either to occlusion of the lumen of the colon or to involvement of coils of small intestine in the inflam matory mass may complicate the disease

Pericolic abscesses subsequently proceeding to fistula formation also occur The fistulae may communicate with the skin surface but in other cases they are internal and give rise to communications between the colon and the adherent small intestines the bladder or other viscera

Surgical Importance of Amoebiasis of the Colon In tropical and sub tropical countries an attack of dysentery associated with the passage of blood stained stools and mucus will at once arouse the suspicion of a specific infec tion and the presence of the amoebae will be sought for in the stools Sig moidoscopy will reveal an inflamed mucosa often pinpointed with haemorrhages and small ulcers the edges of which are swollen with oedema Scrapings from these ulcers may well reveal the presence of the entamoeba histolytica when their identification in the stool itself has not been possible In the later cases areas of more extensive ulceration may be seen and in others an amoebic granuloma may bulge into the end of the sigmoidoscope

The clinician should not overlook the fact that amoebiasis may be present in a chronic or latent form in which for months or years the patient is little affected except for minor periods of diarrhoea In such cases especially if they are seen several years after their return from a tropical country the possibility that an exacerbation of the condition may be due to amoebic infec tion may well be overlooked Whenever a patient may have been exposed to infection and presents with any bowel symptoms the cause of which is not apparent repeated attempts to isolate the amoeba from the stools or from the scrapings from any areas of ulceration in the bowel mucosa must be made before this cause for the symptoms is excluded

Amoebic infection of the caecum may give rise to symptoms indistinguish able from an appendicitis In addition although the entamoeba may have been isolated from the stool the patient may develop a true acute appendicitis unrelated to his amoebic infection In both conditions the surgeon is bound to advise operation but if amoebiasis has been proven or if it is suspected a preliminary injection of emetine should be given and further injections continued in the post-operative period At operation a generalised inflam matory condition of both caecum and appendix will suggest that the infection is not localised to the latter and closure of the abdomen without removing the appendix is then advisable

The differential diagnosis between an appendix abscess and an amoebic granulomatous condition of the caecum may also present a problem As a mass is present however treatment will be expectant and injections of emetine which will be commenced at once will cause rapid resolution if the entamoeba is the cause of the swelling

The presence of a carcinoma of the colon or of the caecum especially when it occurs in a young age group may confuse the diagnosis in a patient with a past or present history of amoebiasis The swelling when it is a carcinoma may be thought to be a granuloma or the latter condition may be diagnosed as a neoplasm of the bowel Certainty of diagnosis may be impos sible and the two conditions may indeed co-exist If the mass is within the limits of examination by sigmoidoscopy biopsies from numerous points must be removed for pathological examination Failure to identify malignant cells makes the diagnosis of an amoebic granuloma likely and if the swelling rapidly

subsides following emetine injections such a diagnosis will be strongly supported

Where it is impossible to obtain a biopsy specimen and the possibility of an amoebic infection is under consideration the therapeutic effect of emetine injections should be tried If however there is but little response or if the mass shows no signs of subsiding whatsoever laparotomy must be undertaken in case the tumour is a malignant one existing on its own or superimposed upon an amoebic granuloma Morgan (1944) draws attention to the improvement of the patient s general condition which may follow emetine injections when both diseases co-exist and this improvement may serve to delay the diagnosis of a cancer **The presence of the latter must always be considered if emetine fails to cause the disappearance of a palpable mass**

Intraperitoneal pericolic abscess formation is treated by drainage though this should be delayed until full localisation has taken place and until a course of emetine has been commenced **General peritonitis** usually occurs in the already gravely ill patient as a result of the perforation of an ulcer around which little or no inflammatory reaction has formed Laparotomy should be undertaken and the perforation exteriorised

Obstruction, following an amoebic infection should be treated conservatively whilst the inflammatory reaction productive of the obstruction is being controlled by emetine injections Most cases will settle but if an operation is required the simplest measures possible should be undertaken to relieve the condition

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CHAPTER XV

VOLVULUS OF THE COLON AND CAECUM

VOLVULUS is a condition in which a portion of the bowel becomes twisted around an axis at right angles to its length The rotation may be clockwise or anti-clockwise and when symptoms of obstruction are produced it has usually exceeded a twist of 180 degrees and may have reached a maximum of 360 degrees

As the bowel rotates the lumina of the two ends of the loop become obliterated so that obstruction develops though in the initial stages this is not accompanied by interference with the blood supply to the affected coil of intestine Later however the vessels entering the meso-colon between the twisted ends of the obstructed coil themselves become obliterated arterial obstruction following the initial occlusion of the veins

In the obstructed loop enormous gaseous distension develops partly the result of decomposition of the retained faeces and partly the result of diffusion of nitrogen from the blood into its lumen This distension is often so great that the distended loop may appear to fill most of the intraperitoneal cavity The wall of the bowel becomes excessively thinned as a result of the stretch to which it is subjected by the raised intraluminal pressure and its outer layers may be split

The intraluminal pressure may be sufficiently high to compress the intra mural vessels The veins are affected first and as a consequence of their occlusion the wall of the colon then becomes swollen with oedema Finally the arterioles become compressed and patchy areas of gangrene develop Thus localised gangrene can be present although the main vessels in the root of the volvulus are not as yet obstructed

A volvulus can only occur when the bowel is suspended from the posterior wall of the abdomen by a mesentery which is of sufficient depth to allow rotation The condition is therefore found most commonly in the pelvic colon where in addition the narrow base of the meso-colon is favourable to a twist Developmental abnormalities in the caecum and ascending colon during the process of rotation of the mid gut whereby these structures are not fixed to the posterior abdominal wall but are left attached by a considerable meso colon occur according to Wolfer Beaton and Barry (1942) in about 11 per cent of cases Because of the presence of a meso-colon in these regions in such a considerable proportion of cases the second most common site of volvulus is in the caecum and Bruusgaard (1947) reports that in Scandinavia half the cases of volvulus affect this region

Volvulus of the transverse colon is rare on account of the fact that the attached ends of the meso-colon are widely separated Olivier and Libaude in 1948 could collect reports of only sixteen cases when adding one of their own

VOLVULUS OF THE PELVIC COLON

Although a meso-colon is a pre requisite for the development of a volvulus the condition is rare even in the pelvic colon This is emphasised by the figures of such authors as Vick who in 1932 could only find 176 cases amongst the records of twenty one major hospitals over a five year period or Gerwig (1950) who operated upon only eight cases in ten years These figures suggest that other factors apart from the presence of a meso-colon are responsible for the formation of a volvulus A congenitally redundant pelvic colon or its elongation as a result of chronic constipation may play a part The much higher incidence of the condition in the eastern European nations is attributed by Bruusgaard to the high proportion of vegetables in the diet the resulting bulky faeces in the colon being more likely by a mechanical effect to produce rotations Inflammatory adhesions constricting and shortening the attached base of the meso-colon are probably contributary factors and violent purgation or dietetic indiscretions have been blamed for the initiation of the volvulus

The condition is most common after the age of forty and the male sex is most frequently affected

Symptoms and Signs of Volvulus of the Sigmoid Colon The condition may be preceded by a series of sub acute attacks of abdominal pain sudden in onset and of a cramplike and colicy nature referred to the centre of the abdomen or to the lower left quadrant Nausea or vomiting may accompany the attack during which the patient may also notice distension of the left side of his abdomen The symptoms are likely to last for a short time only and are relieved by the passage of much flatus

The acute volvulus is ushered in with similar symptoms but instead of being relieved rapidly their severity increases and in spite of a desire to have the bowels opened constipation is absolute Vomiting occurs soon after the onset of the condition and is probably of reflex origin as it may then cease until late in the disease when gangrene is developing or when backward obstruction has spread through the ileo-caecal valve into the small intestine Hiccough is a common symptom and respiratory difficulties and cardiac irregularities may result from the upward pressure exerted on the diaphragm by the distended loop of colon Shock is not marked until the stage of vascular occlusion

On examination of the abdomen distension is evident This is sometimes enormous and usually asymmetric the left side being more affected Peristalsis may be visible in the thinner patients and auscultation will reveal the increased sounds associated with an obstructive condition In the later cases in which peritonitis has developed however both of these signs will be absent

Palpation reveals tenderness over the obstructed loop but initially there is no rigidity Its presence later indicates that vascular occlusion has taken place and that peritonitis has commenced Percussion of the abdomen shows by its hyper resonance the extent of the dilated colon and the area of liver

dullness which may be raised as high as the third rib indicates the degree of upward pressure exerted upon it

Diagnosis and Treatment There is rarely difficulty about the diagnosis but a straight X ray of the abdomen will show the enormously distended colon often spreading beyond the confines of the left iliac fossa Fluid levels as well as gaseous shadows are sometimes seen

When the condition has been present for many hours dehydration may be present and intravenous glucose saline must be given to overcome this Although the fluid lost to the body through vomiting may not be excessive the obstructed loop may contain large volumes and these lost to the general circulation require urgent replacement

If shock is present blood as well as the glucose saline solution will be required and to combat infection all patients should be started on a course of streptomycin and penicillin Where vomiting is marked gastric suction is set up and in all cases when operation is to be undertaken a tube must be passed into the stomach before the patient is anaesthetised and the content of the viscus aspirated

Two methods of treatment need consideration in dealing with volvulus the non-operative and the operative The former method must of course be considered only when the clinician is certain that the obstruction is a simple one and is uncomplicated by any occlusion of the blood supply to the affected loop Such is likely to be the case when the patient is seen within the first few hours of the onset of the condition and when examination reveals a near normal pulse rate a normal temperature an absence of abdominal rigidity and an increase in the intestinal sounds on auscultation

The aim of this form of treatment is to decompress the obstructed loop by insinuating a tube into its lumen thereby allowing the gaseous and fluid content to escape following which the rotation is likely to untwist itself The point of constriction in the lower limb of the pelvic colon is seldom beyond 20 cm from the anus and therefore within reach of a sigmoidoscope which is introduced as far as this point

A long oesophageal tube well lubricated is then passed through the sigmoidoscope and pressed gently against the obstructed area After a little manipulation it may be possible to introduce it into the obstructed loop and the success of the manoeuvre is indicated by the passage of fluid stool and gas through the end of the tube The rapid subsidence of the abdominal swelling is further evidence that the tube has entered the obstructed loop The tube is retained in position for forty-eight hours

This method advocated in the selected case by Bruusgaard amongst others has its dangers Firstly even though generalised vascular obstruction may be absent patches of gangrene the result of local ischaemia may be present in the wall of the colon In these areas the minute arterioles have become obliterated as a result of the grossly raised intraluminal pressure and instead of becoming sealed off by adhesions these patches may leak after the

bowel has been decompressed giving rise to a general peritonitis Secondly the wall of the colon at the root of the volvulus may be particularly oedematous and friable and in attempting to manipulate the tube into the obstructed loop its end may perforate this region Finally although relief of the immediate urgency is achieved the conditions which gave rise to the volvulus still exist and unless operation is undertaken subsequent recurrence is likely

Non operative treatment can only be undertaken as noted above in the early case and it is this type of patient whose general condition has not deterior ated markedly as a result of prolonged obstruction and commencing strangu lation that the risks of operation unless there is other associated general disease are slight We therefore consider that operative treatment is preferable to non operative in these early cases and we would reserve the latter method for those in which by virtue of other constitutional disease operation is contra indicated Where there is any doubt with regard to the vascular supply to the affected loop there is of course no place whatsoever for non-operative treatment

Operative Technique The abdomen is opened through a generous para median incision *Packs are placed around the distended loop to isolate it* insofar as is possible from the general peritoneal cavity Before any attempt is made to untwist the volvulus and thus to relieve the obstruction the grossly distended bowel must be emptied at least in part of its content Efforts to reduce the volvulus before this is undertaken are fraught with the grave risk of rupture of the wall of the oedematous and friable colon There are two methods by which this may be achieved An assistant may pass a rubber tube *into the rectum through the anus and the surgeon can help in its manipulation* through the lower limit of the volvulus With a grossly distended pelvic colon this procedure is by no means easy as it is difficult for the surgeon to isolate the root of the volvulus without some retraction of the colon and this com bined with the manipulations required to ease the tube through the twist at the base of the volvulus may cause a rupture

We therefore consider that it is preferable to select the apex of the volvulus and after further isolation of this region with packs to pass a long wide bore needle connected to a suction apparatus into its lumen The air is rapidly sucked away as well as a considerable part of the fluid faecal content As the bowel collapses the bowel wall recovers some of its normal tone and thickness and it is then possible to insert a purse string suture around the point of entry of the needle without the danger of the stitches entering the lumen of the bowel and thus providing multiple minute punctures through which intestinal content might leak On withdrawal of the needle the suture is tightened and the small wound of its entry is thus closed

The colon is now untwisted The main loop of the volvulus may be obviously viable but especial inspection of its root should be carried out as

the actual twist of the colon in this region may have produced localised areas of necrosis

Where viability is assured a small incision passing through all layers of the abdomen is made in the left iliac fossa and through this the apex of the previously obstructed loop containing the small sealed puncture wound of the needle is delivered The peritoneum is sutured to this emerging knuckle of colon By carrying out this manoeuvre the loop of pelvic colon is fixed to the abdominal wall so that there is no danger of recurrence of the volvulus and in addition the small puncture wound is exteriorised so that should there be any leakage from this there is no danger of intraperitoneal contamination

In those cases in which the bowel is no longer viable the affected region must be excised the two free ends of the colon being brought out on to the surface of the abdomen whenever possible The gangrene is likely to involve the whole of the loop as far back as the root of the meso-colon so that the colon above the upper limb of the volvulus will require mobilisation in order that its end can be exteriorised

The distal limb of the gangrenous loop however may extend so far down into the pelvic colon that it may be impossible to bring the end of the viable bowel below it on to the surface In such cases the open end is therefore closed and covered with peritoneum No attempt must be made to restore continuity following excision of the gangrenous loop Not only is the operative time increased by so doing but the bowel wall above the obstruction is likely to be inflamed and oedematous so that a line of suture made through such tissues is prone to leakage in the post-operative period The restoration of continuity can be undertaken with safety after an interval of a month or so

VOLVULUS OF THE CAECUM

A volvulus in this region affects a somewhat younger group of patients than those in which the twist occurs in the pelvic colon Donhauser and Atwell (1949) analysing a series of 100 cases reported in the literature found that the highest incidence of the condition occurred between the ages of twenty five and thirty both sexes being equally affected In ten cases the volvulus accompanied pregnancy and Rose (1941) has drawn attention to the importance of considering the possibility of this condition where post partum distension of the abdomen is present

In most cases not only is the caecum involved in the rotation which may be clockwise or anti-clockwise in direction but also the distal few inches of the ileum and a varying amount of the ascending colon if this is also provided with a meso-colon

Symptoms and Signs of Volvulus of the Caecum As in volvulus of the colon the final twist of the caecum irreversible except by operation may be preceded by a succession of minor attacks which resolve spontaneously In others these heralding symptoms are absent Where they are present they consist of periodic abdominal pain referred to the centre of the abdomen or

bowel has been decompressed giving rise to a general peritonitis Secondly the wall of the colon at the root of the volvulus may be particularly oedematous and friable and in attempting to manipulate the tube into the obstructed loop its end may perforate this region Finally although relief of the immediate urgency is achieved the conditions which gave rise to the volvulus still exist and unless operation is undertaken subsequent recurrence is likely

Non-operative treatment can only be undertaken as noted above in the early case and it is this type of patient whose general condition has not deteriorated markedly as a result of prolonged obstruction and commencing strangulation that the risks of operation unless there is other associated general disease are slight We therefore consider that operative treatment is preferable to non operative in these early cases and we would reserve the latter method for those in which by virtue of other constitutional disease operation is contraindicated Where there is any doubt with regard to the vascular supply to the affected loop there is of course no place whatsoever for non-operative treatment

Operative Technique The abdomen is opened through a generous paramedian incision Packs are placed around the distended loop to isolate it insofar as is possible from the general peritoneal cavity Before any attempt is made to untwist the volvulus and thus to relieve the obstruction the grossly distended bowel must be emptied at least in part of its content Efforts to reduce the volvulus before this is undertaken are fraught with the grave risk of rupture of the wall of the oedematous and friable colon There are two methods by which this may be achieved An assistant may pass a rubber tube into the rectum through the anus and the surgeon can help in its manipulation through the lower limit of the volvulus With a grossly distended pelvic colon this procedure is by no means easy as it is difficult for the surgeon to isolate the root of the volvulus without some retraction of the colon and this combined with the manipulations required to ease the tube through the twist at the base of the volvulus may cause a rupture

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The colon is now untwisted The main loop of the volvulus may be obviously viable but especial inspection of its root should be carried out as

caecum has been carried out that portion of the wall containing the puncture wound being brought out through a stab wound in the right iliac fossa and being sutured to the peritoneum through which it is passing

In cases of gangrene we consider in accord with the opinion of Gardener that a rapid right hemicolectomy should be performed the terminal ileum being anastomosed to the transverse colon Although in the past exteriorisation of the gangrenous caecum followed by its removal later has been advocated modern methods of anaesthesia and the improved technique of post-operative intravenous fluid replacement gastric suction and antibiotic and chemotherapeutic aids make the former method preferable

Where operation is undertaken for periodic attacks of abdominal pain suggestive of a recurring and resolving volvulus the caecum must be fixed and prevented from further twisting by one of the methods described above

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to its lower and right segment Nausea or vomiting is present and a localised area of abdominal distension may be noticed by the patient This is usually situated in the region of the right iliac fossa but where the peritoneal suspension of the caecum is excessive the rotation of that organ may bring it to lie higher in the abdomen and more medially placed than its customary anatomical location so that the swelling may appear in these areas Constipation is present and the clinical picture is that of a partial obstruction (Gilchrist 1948) These attacks last a few hours only and with the passage of an excess of flatus per rectum they subside

If the volvulus is irreversible these symptoms instead of subsiding become more marked vomiting is frequent and the abdominal pain worsens

Examination of the abdomen will usually reveal localised distension and the contour of the volvulus will be appreciated on palpation The swelling however is never so large or so obvious as that associated with a similar lesion of the pelvic colon and if the condition has been present for several hours the dilatation of the obstructed small intestine behind will cause a generalised abdominal distension in which the volvulus may be obscured Visible peristalsis should be sought for but if absent the increase of peristaltic sounds will indicate the obstructive nature of the lesion Tenderness is present over the volvulus giving place to rigidity as vascular occlusion gangrene and peritonitis develop Gardener (1947) has drawn attention to a group of patients in which associated constitutional symptoms are minimal and the temperature and pulse rate are normal Local signs also are not marked although gangrene has already commenced

Diagnosis and Treatment The acute condition is likely to be confused with acute appendicitis but if the possibility of a volvulus is present in the clinician s mind a localised area of distension will suggest the diagnosis The patient with sub acute attacks may well have been subjected to appendicectomy without relief of his symptoms

A straight X ray of the abdomen will show the air shadow in the distended viscus but for the reasons noted above this is not always localised in the right iliac fossa

The acute case requires urgent operation for its cure after a short pre operative period of intravenous fluid replacement and gastric suction if there is evidence of dehydration or if there has been marked vomiting Before attempting to reduce the volvulus it may be necessary to empty the content of the caecum in the manner described in dealing with a twist of the pelvic colon the puncture wound from the needle being closed by a purse string suture If gangrene has not set in the caecum must be fixed after reduction to prevent further recurrence of the condition Lyal (1946) advised achieving this by using the end of the purse string suture left after removal of the appendix to attach the caecum to the peritoneum of the anterior abdominal wall but more certain fixation can be obtained by exteriorising a small knuckle of its anterior wall This manoeuvre is advisable in any case when decompression of the

Symptoms A previous history of peptic ulceration followed by operation will be obtained Post-operative relief from pain may have been transitory and measured in weeks or months or it may have lasted for many years Pain due to the formation of an anastomotic ulcer will then have returned in nearly all cases This pain is similar in type to that of the original ulcer although usually it is referred to the left of the mid line and is less easily relieved by a medical regime Rarely however the period of anastomotic ulcer formation prior to its perforation into the colon to form a fistula is unaccompanied by any pain remarked upon by the patient Haemorrhage and even perforation may have been complications of the ulcer before the development of the gastrojejunocolic fistula With the formation of the latter the acute pain is often eased or disappears completely Sometimes however it continues unabated or may be replaced by a dull ache referred to the same site

Diarrhoea is the initial and the most constant symptom of the change from ulcer to fistula formation and in Skoog Smith Jaspin and Sullivan s (1950) cases was present in every one The diarrhoea continues unrelieved by the usual medicaments and is frequent and copious although some patients have periodic remissions from this symptom It is likely in such cases that there has been temporary blockage of the fistula either by inflammation or by faecal impaction therein Occasionally solid particles of food may be identified in the stool

Rapid loss of weight is common and associated with this is a general decline in the patient s condition Continued oozing of blood from the ulcer surface is responsible for the anaemia that is frequently present

Belching of faeculent smelling gas may be noticed by the patient or commented upon by his associates and in other cases the vomiting of material which has a faecal smell is complained of

Examination of the patient reveals marked loss of weight and abdominal palpation may demonstrate an area of tenderness over the site of the anasto motic ulcer Rarely an inflammatory mass surrounding the fistula is palpable

The diagnosis may sometimes be confirmed by a straight X ray of the abdomen as the air in the stomach and in the colon may fill the communication that exists between them (Fig 132) If the fistula cannot be demonstrated thus a barium enema will almost certainly reveal its presence and even if the actual fistula cannot be outlined the short circuiting of the barium from the colon to the stomach makes its existence obvious (Fig 133) Its identification by means of a barium meal is far less certain

Preventive Treatment In order to prevent fistula formation every anasto motic ulcer requires early treatment Where therefore symptoms of an anastomotic ulcer are present following gastro-enterostomy further operation should be advised with a view to conversion of the short circuit into a partial gastrectomy Where the stomal ulcer follows an inadequate gastrectomy its conversion into an effective resection must be undertaken and vagotomy

CHAPTER XVI

GASTROJEJUNOCOLIC FISTULAE

GASTROJEJUNOCOLIC fistulae may complicate the development of stomal ulceration secondary to the operation of gastro-enterostomy or partial gastrectomy Its occurrence following primary disease of the colon or stomach such as carcinoma is exceedingly rare but it has been reported by Bargen Kerr Hausner and Weber (1937) following ulcerative colitis

All types of anastomosis of the jejunum to the stomach may at times be followed by fistula formation but its incidence is far commoner when the union between the two structures has been made behind the transverse colon Any ulceration that then develops is in close proximity to the colon so that the latter is almost certain to be bound up in the inflammatory process which as auto-digestion of the tissues by the gastric secretion proceeds may then proceed to perforation of the bowel In Lowden s (1953) series of forty six fistulae thirty nine were associated with a posterior gastro-enterostomy

The incidence of the condition is naturally much higher following a gastro-enterostomy than a partial gastrectomy as on account of the continued presence of a high level of acidity in the former operation stomal ulceration is a common post-operative complication Amongst the authors quoted by Lahey and Swinton (1935) individual variations of the incidence of anastomotic ulcer following gastro-enterostomy range from 1 7 per cent to 24 per cent With the development of such ulceration however the likelihood of fistula formation is considerable and in a series of 169 cases Walters and Clagett (1939) reported its occurrence in twenty three or nearly 14 per cent Hurst and Stewart s (1929) figure of 10 per cent is somewhat lower The more extensive gastrectomies for peptic ulceration now carried out are less likely to be associated with anastomotic ulcer and therefore of fistula formation but two of fourteen cases of fistula reported by Marshall (1945) and four of Lowden s series of forty six had followed this operation

The secondary ulcer that is the forbear of the fistula may arise on the actual line of the anastomosis or in the efferent loop of the jejunum If a fistula develops in the latter case the communication with the colon may be placed several centimetres away from the site of anastomosis but the symptoms to which it gives rise and the treatment to be adopted for its cure are identical in both cases

There seems to be no limit to the length of time after operation at which a patient may develop this complication Langmeyer (quoted by Thomas 1940) reported a case occurring forty years after a gastro-enterostomy and Lowden quotes four cases in which the condition developed within six months of operative treatment

should be carried out at the same time If the gastrectomy has been a high one vagotomy alone is indicated

THE TREATMENT OF AN ESTABLISHED FISTULA

A TWO STAGE PROCEDURES

The mortality of operative procedures for dealing with these fistulas has in the past been high Walters and Clagett reported a 32 per cent mortality amongst fifty cases operated upon between 1928 and 1937 and Gray and Sharpe (1941) one of over 36 per cent in forty nine cases Lahey and Swinton lost five out of eight patients upon whom they operated The causes of death were mostly attributable to an extensive and prolonged operation upon patients debilitated to an extent that rendered them unable to combat the associated shock and to peritoneal infection

Lahey and Swinton suggested that a two stage procedure should be carried out the first stage consisting of an anastomosis of the small intestine to the descending colon Regurgitation of faecal material into the stomach which is considered to be the cause of the gastritis and the resultant diarrhoea associated with a gastro-colic fistula would thereby be in the main arrested After a period of time in which the general condition of the patient would improve the main operation could be undertaken This would consist of a separation of the structures involved in the fistula and their repair as described subsequently Following this a gastrectomy and an excision of the colon proximal to the short circuit carried out in the first stage of the planned treat ment would be undertaken Marshall (1945) reported fourteen cases upon whom this staged treatment had been carried out with only one death

Pfeiffer and Kent (1939) reported two cases in which they had instituted a colostomy in the ascending colon before subsequently proceeding to the main excision of the fistula Both patients were grossly emaciated but after the initial operation and before the second stage was undertaken had gained many pounds in weight These authors attributed the relief of diarrhoea and the great improvement in the general condition of their two patients to the fact that the colostomy prevented regurgitation of faecal material through the fistula into the stomach They argued therefore that it was not the stomach content pouring into the colon that produced the diarrhoea but the entry of faecal material into the upper intestinal tract The introduction of bacteria may well produce an enteritis

This method of treatment is therefore an alternative to that suggested by Lahey and Swinton when a two stage procedure is under consideration Its merit is emphasised by Pfeiffer who in 1941 reported fifteen cases in which his technique had been employed with but one death

The institution of a colostomy in the ascending colon has the disadvan tages that its discharge is only semi solid and that it tends to excoriate the skin Pfeiffer and Kent chose the ascending colon as the site for the colostomy because in their initial cases the transverse colon was so involved in the



FIG 132
A straight X ray of the abdomen showing a gastro jejunocolic fistula outlined with air



FIG 133
A barium enema X ray showing the barium passing into the stomach from the transverse colon through a fistulous communication

OPERATIVE TECHNIQUE

The abdomen is opened through a paramedian incision The inflammatory mass surrounding the fistula is immediately apparent and the first step in the operation is to separate the omentum and any coils of small intestine which are not directly involved in the fistula from this area

It is now easiest to approach the fistula by cutting along the mesenteric margin of the colon As the cuts with the scissors proceed the lumen of the bowel will be opened in the vicinity of the fistula it is then not difficult to separate the colon entirely from the gastro-enterostomy

The rent in the colon is examined and a decision has to be made whether to oversew the hole or to resect the segment of bowel containing it subsequently restoring continuity by an end to-end anastomosis If the hole is large or if there is fibrous thickening of its edges to a marked degree we prefer to carry out a resection This takes slightly longer than simple suture but a more efficient repair is effected and the likelihood of any post-operative leak is correspondingly reduced

The fistula now lies open and the surgeon proceeds to separate the jejunum and the stomach by deliberately cutting across their line of union Spilling of stomach of intestinal content is prevented by the application of non-crushing clamps

When the anastomosis is freed a further decision has to be made—whether to oversew the rent in the jejunum or whether to resect the affected segment and carry out an end to-end anastomosis The rent is often large and its edges inflamed and indurated Closure by oversewing may cause considerable obliteration of the lumen of the jejunum especially as several reinforcing layers of sutures will be required to make certain that the repair is watertight As a rule therefore we prefer to excise the damaged segment but in cases where the anastomosis has contracted up so that the opening into the intestine is small and where the calibre of the affected region of the small intestine is wide simple closure is sufficient To complete this part of the operation the hole in the stomach is closed so that where the original operation was a gastro enterostomy the anatomy is now restored to normal (Figs 134 135 and 136) The general condition of most patients is good at this stage so that the surgeon can then proceed to carry out the second part of the operation the gastrectomy This follows the usual lines but the jejunum used for the anastomosis should be taken from a loop that lies distal to the repair

If there is any doubt about the patient s condition when the normal anatomy has been restored the operation can be stopped at this point and the gastrectomy can be delayed until some weeks later There is of course the possibility that as a result of the complete relief of his immediate symptoms the patient will refuse to undergo further operative treatment when this is advised There is then the danger that as the operative factors in the production of the ulcer have not been relieved a peptic ulcer may recur with the consequent risks of complications such as haemorrhage or perforation This

inflammatory process about the fistula that it could not have been exteriorised readily Lowden however has been able to establish a proximal colostomy in the transverse colon in fifteen cases

B ONE STAGE PROCEDURE

The improvement of pre and post-operative preparation of the patient the introduction of chemotherapy and antibiotics and the modern methods of anaesthesia have extended the scope of surgery so greatly that we consider that except in the very debilitated and emaciated individual who has failed to respond to pre operative build up it is best to treat the condition by a one stage operation Such an operation will entail the following steps —

1 The complete separation of the three structures involved in the fistula namely the stomach the jejunum and the colon

2 The repair of the holes in these organs after separation has been completed or in the case of the jejunum or the colon a resection of the involved areas with restoration of continuity by end to-end anastomosis

3 The conversion of the operation on the stomach into a partial gastrectomy where previously a gastro-enterostomy had been carried out or a higher resection combined with vagotomy where the excision of the stomach has been inadequate

Pre operative Preparation In the treatment of a fistula by a one stage operation attention to the preliminary pre-operative preparation of the patient is essential for success A full blood examination will reveal the extent of the anaemia and the degree to which the plasma proteins the plasma chlorides and the serum potassium have been depleted All must be raised to normal values by intravenous transfusion of the appropriate fluids and associated dehydration most marked in the cases in which both vomiting and diarrhoea have been present must also be corrected Vitamin deficiencies are often present and heavy pre-operative doses especially of vitamin C, must be given The diet should be of a high calory and high protein content

At least a week should be devoted to stomach washouts If the returns are very dirty these must be carried out in the first few days twice daily In the last three days of the pre operative regime colonic irrigations are given These must be carried out with skill and gentleness and although many litres of fluid may be used during an irrigating session only 75 100 cc are run in at one time and these are aspirated back before continuing The little fluid that runs through the fistula into the stomach causes no harm and no discomfort but the irrigations produce a colon that is practically free of faecal content so that the large intestine can be opened with added safety Aureomycin is used as a bowel sterilisant and penicillin is commenced in the last but one pre operative day

however the patient must be prepared to accept if the second stage of the operation is refused

In those cases in which the fistula has followed a low gastrectomy the above operation cannot be divided into two parts At the outset therefore a decision has to be made as to whether the patient s general condition is sufficiently good to withstand the larger operation If there is doubt the procedure advocated by Lahey and Swinton or that recommended by Pfeiffer and Kent is best performed the cure of the condition being undertaken in two stages Both procedures would seem to give equally good results

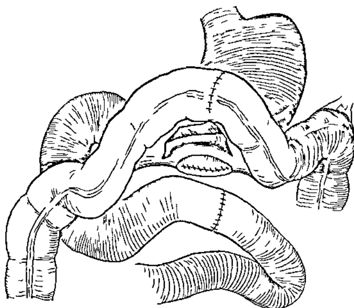


FIG 136
The damaged area in the jejunum has been excised and end to end anastomosis performed The hole in the stomach has been oversewn and the anatomy restored to the normal

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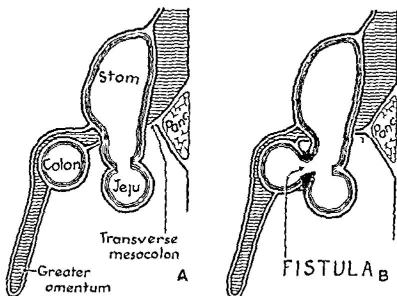


FIG 134

Diagram to show the altered anatomy following the formation of a gastrojejunocolic fistula

(a) The anatomy at the end of a gastro enterostomy

(b) The anatomy when a fistula has formed

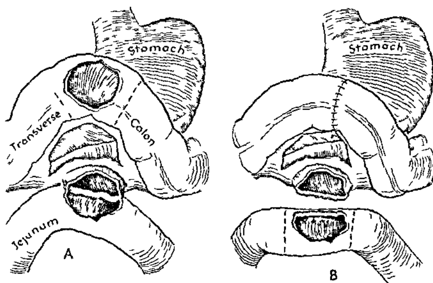


FIG 135

Diagram to illustrate the separation of the component parts of the fistula and their repair

(a) The colon has been separated from its union with the fistula The dotted lines indicate the region to be resected The posterior wall of the anastomosis between the stomach and the jejunum is still intact

(b) The damaged area of the colon has been resected and end to end anastomosis carried out The stomach and the jejunum are now separated

times affected and in one of their cases the narrowed bowel from which ganglion cells were absent extended as far up as the splenic flexure

They suggested that in these cases the disease was due to a failure of the transmission of the normal co-ordinated waves of peristalsis through the section of the bowel from which the intramural plexuses were absent and that the dilatation and hypertrophy of the colon above this region were secondary to the inability of the intestine to force the faeces through this inert structure

Reviewing a series of cases of megacolon at the hospital for sick children Bodian and his co-workers after excluding any in which an organic cause was demonstrable divided the seventy three patients on clinical and radiological findings into two groups The first in all of which a narrowed segment of the pelvi rectal region was demonstrable were described as cases of true Hirschsprung s disease and the second because no obvious pathology was found to account for the condition were included in a general group of idiopathic megacolon These two types are now discussed

HIRSCHSPRUNG S DISEASE

The disease is far commoner in boys than in girls in the proportion of 9 to 1 (Bodian 1952)

Symptoms and Signs The symptoms of infants or children suffering from this condition begin soon after birth and the first indication that any abnor mality is present is a delay in the passage of the first meconium stool Digital attempts to encourage the evacuation may be made by the physician or nurse in attendance on the case and initially the difficulty may be overcome but it soon becomes obvious that the infant is constipated and days or even weeks may pass without an unaided evacuation The feeding of the child may be held responsible for the abnormalities and a variety of different foods may be tried in an endeavour to overcome the increasing constipation now relieved only by enemata suppositories and purgation

The infant fails to gain the normal weight increases and at an early date the abdominal distension becomes noticeable Periodically acute flare ups of total obstruction occur so that the abdomen becomes still more distended and vomiting ensues From these attacks the child may recover spontaneously the recovery being associated with the passage of flatus and some faecal material In others death is likely unless the condition is relieved by a decom pression colostomy When the bowels do open the stools passed by these small patients are noticeably smaller than usual

Untreated most of these sickly children die at an early age of intercurrent infections such as pneumonia or of malnutrition if the acute stages of obstruc tion and its complications do not cause their death If they survive they are much undersized with greatly distended abdomens and with flared costal margins the result of the upward pressure exerted upon the ribs by the disten sion of the colon It is extremely rare for a child suffering from Hirschsprung s disease to reach adult life

CHAPTER XVII

DISEASES OF THE COLON DEPENDENT UPON CONGENITAL ABNORMALITIES

MEGACOLON

UNTIL recent years the name Hirschsprung s disease was given to any condition of megacolon in which the disease had existed from an early age and in which no obvious organic lesion was identifiable as being responsible for the obstruction The condition bore the name of the man who originally described it in 1887 and no attempt was made in its title to indicate the essential pathology of the disease as none was known It was thus that various types of megacolon differing widely in their clinical course and as has been shown recently in their aetiology became accepted as a single entity and that such varying results of success and failure in the treatment of these cases came to be recorded

It is largely as a result of the work of Bodian Stephens and Ward (1949) that the definite clinical features of the type of megacolon that now bears the name of Hirschsprung s disease have been segregated from others the aetiology of which often still remains obscure

That a narrowing of the pelvi rectal region was present in certain cases in marked contrast to the enormous distension of the bowel above was commented upon by Bartle (1926) and the condition came to be regarded as due to a spasm of the muscle in this region the result of sympathetic over activity Lumbar sympathectomy stripping the inferior mesenteric artery of its surrounding plexus and in some cases repeated spinal anaesthesia (Hawksley 1944) were therefore carried out in an effort to eliminate the assumed preponderance of sympathetic impulses to the narrowed sector of the large intestine Although improvement and cures were recorded response to the treatment was uncertain

In 1938 Robertson and Kernohan reported from the Mayo Clinic their post mortem findings on the microscopic examination of the narrowed segments of the pelvi rectal region of certain patients suffering from megacolon They found that in several cases there was degeneration and lack of the normal ganglion cells present in the intramural plexuses of Meissner and Auerbach and Whitehouse and Kernohan (1948) confirmed these initial investigations and reported the absence of ganglions in all their cases of congenital megacolon Bodian Stephens and Ward (1949) examining fifteen specimens in which pelvi rectal narrowing was present showed that not only was there a complete absence of parasympathetic ganglion cells in the narrow segments but that this absence extended into the dilated part for a distance of from 1 5 cm They also commented upon the variation in the length of the bowel some

By means of a barium enema it is possible to demonstrate the narrowed pelvi rectal segment leading from the megacolon above to the normal ano rectal region below (Fig 137) In order to identify this region however no preparatory colonic irrigations should be given before the X ray examination as this may empty the dilated colon above and thus permit it to contract down If this occurs it will be impossible to demonstrate the contrast between the dilated bowel above and the narrow sector below Moreover the installation of radio-opaque fluid must be slow and as soon as the lowest portion of dilated bowel is visualised it must be stopped (Swenson and Bill 1948) If more than this minimum quantity is instilled the barium filled loops of colon will overlie and obscure the narrowed segment of the bowel thus rendering its visualisation impossible

IDIOPATHIC MEGACOLON

Aetiology The aetiology of this type of megacolon is obscure and its clinical differentiation from Hirschsprung s disease has been emphasised by Stephens (1948 1949) Although the constipation may date from birth it is then usually of a mild nature and only becomes severe in later infancy or childhood Sometimes the condition appears to start following an illness in which the regular routine of bowel training is neglected whilst in others a mild degree of pre-existing constipation and megacolon is increased by this neglect

Lee Bebb and Brown (1950) suggested that in some cases at least a congenitally enlarged sigmoid colon was responsible for the disease Over absorption of water in an enlarged colon of this nature might well produce such inspissation of the faeces that their evacuation would become difficult Moreover the almost constant presence of hard faecal masses in the pelvic colon would be likely to dilate and enlarge it still further so that a vicious circle would be created

In an established case it is of course impossible to say whether the elongation and hypertrophy of the pelvic colon is the result or the cause of the condition Jones and Morton (1938) have commented favourably on the results of operative removal of the redundant colon and at the Royal Society of Medicine Gardiner (1953) has also reported a good return to normal bowel function following excision of the pelvic colon These good results however are not the experience of all surgeons and following resection and end to-end anastomosis elongation and dilatation of the remaining colon may recur Although it is therefore possible that in some cases of idiopathic megacolon a congenital enlargement and elongation of the pelvic colon may be the cause of the increasing megacolon this aetiological factor cannot be considered as causative in every case

Symptoms and Signs The rectums of these children are constantly full of faeces and leakage of faecal stained mucus is common When the bowel

Diagnosis On examination of these patients the undernutrition and the gross abdominal distension often associated with borborygmi and visible peristalsis is obvious The distension of the abdomen is usually greater than that accompanying the condition of idiopathic megacolon Rectal examination



FIG 137

A barium enema from an infant suffering from Hirschsprung s disease The bowel above the narrowed segment is enormously distended the dilatation funnelling into this region *(By courtesy of Dr Martin Bodian and Messrs Wm Heinemann Ltd)*

reveals a marked difference between the two conditions In Hirschsprung s disease the finger passes into a tight feeling empty rectum through the wall of which hard faecal masses may be palpated in the colon lying above In idiopathic megacolon on the contrary the examining finger at once enters an enormously dilated rectum filled with a mass of faecal material

does act as a result of the administration of purgatives enemata or suppositories a bulky stool is passed in sharp contradistinction to the rabbit like or strip like stool passed in Hirschsprung s disease Complete obstruction is rare and the mortality rate associated with the disease is low

On examination of these children the general condition of nutrition and development is better than that in Hirschsprung s disease and the abdominal distension and flaring of the ribs is much less marked Visible peristalsis is usually absent although large faecal masses may be palpated throughout the colon The findings on rectal examination are very different from those of Hirschsprung s disease Instead of entering a rather tight rectum from which the faeces are absent the finger passes into a dilated organ filled with faeces down to the anal canal

A barium enema X ray shows no narrowing of the pelvi rectal region and in contradistinction it is dilated (Fig 138A and B) Stephens (1949) described two types of dilatation which had been demonstrated by his colleague Ward In the *terminal reservoir type* the dilatation is confined to the lower pelvic colon and the rectum In the *tubular dilatation type* the whole of the sigmoid colon as well is involved in a uniform distension This separation of the two types is a purely radiological one and there is no clinical difference X ray examination reveals no evidence of spasm of the external or internal sphincter mechanisms and the barium is usually evacuated fairly easily

TREATMENT

Hirschsprung's Disease Conservative treatment with enemata and purgation at its best can only temporarily improve the condition and no cure can be expected In view of the fact that obstruction is likely to develop in two thirds of these infants before reaching their first birthday and because the pathological basis of the condition is now well established operation offers these infants the best chance of survival

Swenson and Bill (1948) were the first to carry out an excision of the aganglionic segment of the pelvi rectal region restoring continuity by anastomosing the pelvic colon above and the ano rectal region below by a pull through method In their early cases a preliminary colostomy was first instituted but Swenson Neuhauser and Pickett (1949) subsequently described cases the youngest of which was two months old in which the operation was carried out without this initial stage In this report twenty three cases were described eight of which were operated upon without a preliminary colostomy and in the series there were no deaths All the children had returned to normal health and normal bowel habit

After preliminary bowel preparation with irrigations and antibiotics the abdomen is opened and the lower pelvic colon and the rectum are mobilised This mobilisation is similar to that of the preliminary stages of Miles s abdomino perineal operation with the exception that as the surgeon is dealing with a benign condition the separation from its surrounding tissues is effected



A



B

FIG 138A and B

Gross distension of the pelvic colon and of the rectum in a case of idiopathic megacolon The dilatation is uniform throughout the rectum and there is no narrow segment Fig 138B illustrates the X ray appearance one week after a barium enema In spite of repeated washouts much barium has still been retained

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of the rectal stump is then carried out in a similar fashion to that of the anastomosis of the anterior walls and continuity of the bowel is thus re-established The suture line is pushed gently upwards so that it comes to lie just above the internal sphincter and the operation is completed by the closure of the abdomen by the surgeon working in this region

Browne (1949) has described a method in which following a preliminary colostomy the bowel is intussuscepted through the anal canal without first dividing it as in Swenson s operation The subsequent amputation and anastomosis is similar to that carried out in the latter procedure The merit of this operation would seem to be that as the colon is not cut across inside the general peritoneal cavity the risk of infection is minimised but Swenson s results show that with efficient pre-operative preparation of the bowel this is a remote danger

Although a transverse colostomy may be instituted as an initial stage in either of the above operations it is an essential and life saving preliminary in any case in which acute obstructive symptoms have developed When the child has recovered from this complication of the disease the excision of the aganglionic organ is undertaken and the colostomy is closed subsequently Figures 139 and 140 illustrate a child so treated

Idiopathic Megacolon This condition responds in most cases to conservative treatment Careful training in the setting up of a regular bowel habit is essential and evacuations are aided whilst this is being regularised by purgation and by enemata That any form of sympathetic denervation of the distal bowel produces on its own and unaccompanied by conservative treatment improvement of the condition still remains unproven but in cases which have not responded to a careful and prolonged non-operative regime sympathectomy must be considered Before this is undertaken Hawksley suggests that a light spinal anaesthetic should be administered on one or more occasions as marked improvement may sometimes follow this form of therapy

Jones and Morton have reported successful results following the removal of the dilated pelvic and descending portions of the colon Restoration of continuity was established by anastomosis of the distal portion of the transverse colon to the upper rectum

ANOMALIES OF INTESTINAL ROTATION

The complicated process occurring in early intrauterine life whereby the mid gut is withdrawn into the coelomic cavity and the caecum and the ascending colon rotate from the left to the lower right sector of the abdomen is one the incompletion and abnormalities of which are responsible for varying types and degrees of intestinal obstruction Dott (1923) in a classic paper described and segregated the various anomalies that can occur any of which may give rise to symptoms

Volvulus of the whole or of a part of the structures derived from the primitive mid gut the result of failure of mesenteric fixation although rotation

close to the bowel The bowel is then divided above the narrowed region and the two ends are closed The lower end is intussuscepted through the anal canal and it is drawn outwards through *the anus by an assistant*

A transverse incision is now made in the anterior wall of this everted bowel 3 cm below the level of the junction of its mucosa with the skin of the *perianal region and forceps are inserted through this* opening and are passed



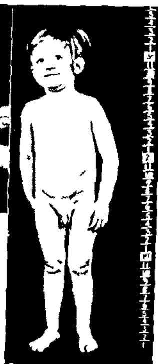


FIG 139
An emaciated infant aged five months showing the characteristic features of Hirschsprung s disease

FIG 140
The same child aged three and a half years two years after recto sigmoidectomy

(Figs 139 and 140 by courtesy of Dr Martin Bodian and The Practitioner)

FIG 140

upwards into the peritoneal cavity Into their tips the surgeon working in the abdomen guides the free ends of the suture used to close the severed upper end of the pelvic colon These are grasped and on withdrawing the forceps the pelvic colon is pulled downwards to emerge through the transverse incision previously made in the intussuscepted portion of the bowel

The terminal portion of the closed end of the upper pelvic colon is cut across to open its lumen and its anterior wall is then sutured to the free edge of the anterior wall of the everted portion of the bowel This anastomosis is carried out in two layers the first approximating the sero muscular coat of the pelvic colon to the fibro muscular coat of the rectum by means of interrupted sutures and the second a continuous suture passing through all layers of the adjacent free edges of the approximated parts of the intestine

The transverse incision in the anterior wall of the everted portion of the rectum is now continued posteriorly to amputate this part of the bowel The anastomosis of the posterior wall of the pelvic colon to the posterior free edge

of the rectal stump is then carried out in a similar fashion to that of the anastomosis of the anterior walls and continuity of the bowel is thus re-established The suture line is pushed gently upwards so that it comes to lie just above the internal sphincter and the operation is completed by the closure of the abdomen by the surgeon working in this region

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Volvulus of the whole or of a part of the structures derived from the primitive mid gut the result of failure of mesenteric fixation although rotation

is otherwise complete is comparatively common Less commonly the condition is associated with a failure of the rotation of the caecum this part of the large intestine being held up in the epigastric region where it lies in front of the third part of the duodenum tethered there by folds of thickened peritoneum *In this type of volvulus too the failure of fixation of the mesentery* of the mid gut is the factor which allowing abnormal mobility and movement to occur is finally responsible for the onset of the condition

During the normal process of rotation the caecum and the ascending and transverse portions of the colon which follow it pass in front of the superior mesenteric vessels Rarely these portions of the mid gut pass behind these vessels a condition known as **reversed rotation,** so that the attachment of the mesentery of the small intestine to the posterior abdominal wall comes to be interrupted by an arcade arching over the large bowel The duodenum then lies directly anteriorly to the colon The arcade through which the colon passes may cause obstruction to this proximal part of the large intestine of a complete or incomplete type

Finally when the caecum is held up in the epigastric region the folds of peritoneum tethering it in this position and passing in front of the duodenum may produce obstruction to the latter Ladd (1947) has drawn attention to the fact that this **high small intestinal type of obstruction** may co-exist with a volvulus of the mid gut so that in every case in which the latter is reduced the duodenum should be inspected to make certain that it is not obstructed

The incidence of these congenital abnormalities is represented by the series of cases reported by Gardner and Hart (1934) In adding two of their own to 103 cases previously reported they found that seven were due to duodenal obstruction ten to reversed rotation and eighty-eight to a volvulus in which the entire mesentery of the mid gut was involved

Symptoms, Signs and Diagnosis The symptoms of obstruction resulting from these anomalies may be present in the first few weeks of life and may be those of a complete or those of an incomplete lesion The infant commences to vomit most of its feeds and the fact that the returned food is in almost every case bile stained distinguishes the condition from hypertrophic pyloric obstruction Where the obstruction is caused by pressure on the duodenum the upper part of the abdomen only becomes distended and it is here that visible peristalsis may be identified If a volvulus of the whole of the mid gut has occurred the abdominal distension is likely to be uniform in its distribution and in those infants in whom the right side of the colon is obstructed in reversed rotation the distension is initially confined to that side

Constipation is not absolute when the obstruction is incomplete and the passage of stools may serve to mask the nature of the lesion A straight X ray of the infant s abdomen is a useful aid to diagnosis and will probably reveal distended loops of intestine though in duodenal obstructions the child s vomiting may be sufficient to expel the air from the stomach so that no dilatation is detected If the condition of the patient is sufficiently good the site of the

obstruction can be identified by the administration of a very small thin barium meal

In those patients in whom the symptoms of obstruction are mild and transient the cause of the periodic attacks of abdominal distension and vomiting may well escape recognition until childhood is well advanced or even until adult life has been attained Only then following a full X ray examination of the gastro intestinal tract or when an acute obstruction finally supervenes upon the many previous minor episodes may congenital abnormality of rotation be identified

Treatment

Where the symptoms and signs of obstruction are present operation must be undertaken If the infant is dehydrated pre-operative administrations of intravenous 10 per cent glucose solution and subcutaneous normal saline of each 10 cc per pound body weight should be given A fine tube must be introduced into the stomach through the nasal route in order to empty the intestines above the point of their obstruction of their contained fluid By so doing not only is the abdominal distension reduced and the operation thereby made easier but the danger of aspiration of the intestinal content into the lungs during the preliminary stage of the anaesthetic is eliminated

The abdomen is opened through a long paramedian incision If obstructed and twisted coils of intestine immediately present these are delivered into the wound and the volvulus is untwisted Ladd (1947) has emphasised that after the relief of the obstruction to the mid gut in this way it is essential to inspect the duodenum to ensure that it too is not being obstructed by external pressure from a misplaced caecum If such is the case or if this alone is producing the obstruction the peritoneal folds passing towards the right of the abdomen and holding the caecum in its abnormal position must be incised so that the latter structure can be pushed gently away from the duodenum towards the upper left quadrant of the abdomen

Following the reduction of the volvulus of the mid gut both Ladd (1932) and Brenner (1932) have reported recurrences of the condition Fixation of the mid gut to the parietal peritoneum by a few interrupted sutures is there fore essential to prevent this

In those cases in which the obstruction is the result of a reversed rotation the orifice in the mesentery of the small intestine through which the large bowel is passing must be enlarged This can be achieved by incising the attachments of the mesentery to the posterior abdominal wall above and below the orifice

In the first few post-operative days gastric suction and intravenous and subcutaneous fluid and electrolyte replacement are required and feeding by mouth is commenced as soon as peristalsis returns

ENTEROGENOUS CYSTS

These cysts which Ladd (1947) has referred to as reduplications of the intestinal track have been recorded at all sites from the oesophagus to the rectum According to McLanahan and Stone (1934) they are most common in the ileo-caecal region and least common in the rectum They are the result of the isolation of the small diverticula which Lewis and Thyng (1907) described occurring in the foetal entoderm during the process of development of the primitive gastro intestinal track Usually these reduplications do not communicate with the bowel to which they are intimately attached or the communication is so small that their secretions cannot drain into the lumen of the intestine In other cases however as in the ileo-caecal cyst described by Evans (1929) the communication may be sufficiently large to allow the periodic discharge of the contents of the cyst so that the swelling may vary in size or on occasions completely disappear

These cysts lie in close contact with the portion of the intestine from which they arise and the muscular layers of the bowel wall spread out to provide similar and complete covering to the reduplication It is therefore impossible to dissect the cyst away from the part of the bowel to which it is related without considerable damage to the wall of the intestine as the length of the attachment is often extensive As the cyst distends with its own secretions its increase in size causes the intestine to become stretched across it with the result that its lumen is diminished and obstruction may result

Symptoms, Signs and Diagnosis These reduplications may give rise to symptoms in early infancy although their distension and consequently their *recognition may be delayed until adult life Local pain in the region of the* swelling may cause the patient to notice the presence of a lump in his abdomen but usually abdominal colic with periodic vomiting and abdominal distension cause him to seek medical advice In others the patient may not be seen until acute obstruction has supervened from pressure of the cyst on the bowel to which it is attached Ladd (1947) reports a case in which the cyst had given rise to an intussusception

On abdominal examination it may be possible to identify the cystic swelling and a barium enema in the non obstructed case may show a defect in the normal lumen of the colon due to the presence of a mass outside its walls In other patients the cause of the obstruction may only be revealed during laparotomy

TREATMENT

Wherever possible the cyst together with the region of the colon from which it arises should be excised and continuity of the bowel re-established by anastomosis If the cyst arises from the ileo-caecal region a right hemicolectomy will be necessary but elsewhere in the colon a local excision suffices If the cyst is so bound down to the surrounding structures that its mobilisation is impossible without the danger of injury to these or to their vascular supply

an anastomosis between it and the adjacent bowel must be effected This will serve to drain its content into the colon but the danger of subsequent infection in its cavity as a result of faecal material stagnating therein is a real one and the operation should therefore be carried out only when excision is not feasible

CONGENITAL ATRESIA AND STENOSIS OF THE COLON

Atresia of the colon, the result either of a septum placed across the lumen of the bowel or of the failure of the lumen to develop in a segment of the large intestine is a rare cause of complete obstruction in infancy The obstructive symptoms will be apparent soon after birth and the diffuse abdominal distension that is present makes it likely that the lesion is at a low level A straight X ray of the abdomen may show the coils of intestine dilated with gas as far as the site of the obstruction Microscopic examination of any stool that has been passed will fail to reveal the presence of the stratified cells of the vernix caseosa which are a normal constituent of the meconium and which in total obstruction cannot reach the outside Farber (1933) drew attention to the absence of these cells in total obstruction of the newborn and devised a simple method for demonstrating their presence or absence

Treatment After preliminary pre-operative preparation with subcutaneous and intravenous transfusions when required and the institution of gastric suction in all cases operation must be undertaken This will consist of a side to-side anastomosis of the small intestine to the large bowel beyond the site of the obstruction This anastomosis is not an easy one as the calibre of the colon beyond the obstruction is very small

Stenosis of the colon may result from incomplete congenital abnormalities of the type described above They may give rise to such a degree of obstruction that operation early in infancy will be necessary In other cases periodic attacks of abdominal distension associated with vomiting and constipation may continue into late childhood without the cause of these symptoms being recognised X ray examination may finally establish a diagnosis

Treatment The operative treatment is similar to that of an atresia The more normal size of the colon distal to the obstruction however makes this an easier procedure

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CHAPTER XVIII

GUNSHOT WOUNDS AND OTHER INJURIES TO THE CAECUM AND COLON

GENERAL CONSIDERATIONS

THESE injuries may be associated with penetrating wounds or they may occur as a result of traumata in which there has been no breach of the epithelial surface of the body Often they are accompanied by damage to other parts of the intestine or intraperitoneal viscera Though the rupture of the large bowel usually communicates with the general peritoneal cavity so that subsequent peritonitis is inevitable the injury may involve an extra peritoneal portion of the colon only In such cases the patient is spared the dangers of peritonitis but those of infection of the extraperitoneal tissue spaces consequent upon their contamination with faeces may still be serious

The point of entry of the missile which ends its course by injuring the bowel is by no means always confined to the region of the abdomen Bullets or shell fragments may cause damage after entering the body low down in the thigh or through the muscles high up in the shoulders so that particularly in war casualties the possibility of an intra abdominal lesion in association with distant wounds must be forever present in the surgeon s and the forward medical officer s mind

Intra abdominal rupture of the colon or caecum in civilian practice may follow a kick or a blow on the abdominal wall The resulting perforation may not be immediate but may be delayed for periods of many days When this occurs the initial trauma has either ruptured the outer coats of the bowel or produced a haematoma in its wall subsequent distension or infection causing the weakened colon to give way If abdominal examination following such an injury reveals tenderness or guarding of the muscles when other signs of bowel perforation are absent the clinician must bear in mind the possibility that the wall of the large intestine may have been injured with out a breach of its continuity These cases must be kept under strict observa tion so that should a delayed perforation develop it may be quickly recognised

Similar injuries occur in wartime as a result of the effect of under water explosions by depth charges or by bombs when these missiles are dropped in the vicinity of the survivors of sunken ships

Without surgical intervention nearly 100 per cent of cases suffering from intraperitoneal injury of the large intestine will die and if surgery is delayed for more than ten hours the mortality rate associated with operation shows a steep rise It is therefore essential that diagnosis is early so that in war especially priority of evacuation to a forward surgical centre can be given to

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the wounded will suffer from severe vomiting and cramp-like or colicy abdominal pains which may be accompanied by the passage of blood per rectum Rupture of the bowel is not necessarily present in such cases and the symptoms are often due to multiple areas of bruising in the wall of the colon one or more of the haematomas discharging through the mucosal lining in those patients who suffer from rectal bleeding The diagnosis of a ruptured bowel must only be made if in addition the examination of the patient reveals signs suggestive of such a lesion Nevertheless it must not be forgotten that the damaged bowel may rupture subsequently and for two weeks after the symptoms have settled the patient should therefore be retained under hospital supervision

The diagnosis of an intraperitoneal rupture of the bowel is very obvious when a large rent is present on the surface of the abdomen through which faeces discharge or where the patient lies shocked with a rigid abdomen guarding the underlying injured viscera But where the patient is apparently fit and well where the wound of entry is far away from the abdominal wall or where if on the abdomen the entry wound is minute difficulty is likely to be experienced and every factor in the examination of the patient has to be carefully assessed in arriving at a final conclusion

Abdominal palpation may reveal tenderness and guarding of the muscles about a wound in this situation but such signs exist around any lacerating injury that has ruptured the muscles and which has not penetrated the peritoneum It is true that in an intraperitoneal injury these signs are more marked but the line of differentiation is a fine one A quickening of the pulse will favour the latter diagnosis but in the difficult case in which the perforation of the bowel is minute and in which peritonitis has not yet developed the pulse rate is often normal

Auscultation of the abdomen is of the greatest aid in the diagnosis of an intraperitoneal injury and if the peristaltic sounds are normally brisk in all segments such a danger is a remote possibility If they are altogether absent an intraperitoneal lesion is a certainty whereas should they be reduced to an occasional tinkle or should they be audible only in one sector of the abdomen such an injury should be suspected and the closest observation kept upon the patient Further diminution of sounds an increase in the tenderness about a wound in the abdominal wall or any increase in the pulse rate are factors that will then confirm the diagnosis in favour of an intraperitoneal injury

Rectal examination should always be carried out in the doubtful case as a rent in the pelvi rectal region may be palpated and the presence of blood on the examining finger is usually indicative of a rupture

We have not found the **obliteration of the area of hepatic dullness** by free air in the peritoneal cavity of great value as in the cases in which this sign has been present other more obvious signs have made the diagnosis apparent

these wounded The diagnosis must therefore depend upon the forward medical officer and he should be very familiar with the symptoms and signs of bowel perforation

The forward surgical unit dealing with these casualties must be so sited that the delay between the evacuation of such casualties from the forward dressing station at which the wounded man usually arrives some hours after his injury and their arrival there is reduced to a minimum and if possible should not exceed two hours Apart from the actual time lag long journeying over rough roads and tracks adds to the shock from which the patient is already suffering so that his condition declines

The surgical unit however must be so placed that it is unlikely to be required to be removed for some days after the last abdominal wound has been treated as experience during the last war showed that early evacuation after operation is not well borne by these patients The positioning of medical units requires therefore a careful balance between the considerations of war fare and those of surgery and not unnaturally the two coincide more readily in times of advance than in those of retreat

Evacuation by air ambulance will modify considerably the siting of medical units in a future war but caution is required in the transport by such means of those with abdominal wounds Low flying must be insisted upon as in higher flights gaseous expansion in the intestine will take place with the result that bubbles of gas escaping from a perforation will break down any natural sealing process that may have occurred and will convert a localised into a generalised peritonitis Similarly in the post-operative phase when any lines of suture in the intestines have not as yet finally healed high altitude flying should be forbidden on account of the danger of their rupture

DIAGNOSIS

If the possibility of intra abdominal injury is thought of in all cases of gunshot wounds above the knee and below the axilla, the missed case will be reduced to a rarity At the same time it is equally essential under the condi tions appertaining in war surgery and in the presence of other associated gross wounds to avoid opening the abdomen unnecessarily The diagnosis must be as near certain as is possible and the attitude of undertaking an exploration in case the bowel is injured is one to be deprecated

In gunshot wounds the **history** is of little help except that early vomiting is suggestive of an intra abdominal lesion All do not suffer this symptom but vomiting within the first few hours of the receipt of an extraperitoneal injury was not common in our experience with casualties in the last war

In **blast injuries** due to an under water explosion the latter incident will have been recorded and those who are possibly suffering from an intra peritoneal injury often describe a feeling as if they had received a sudden and severe blow in the back at the time of the explosion sometimes associated with a partial paralysis of the lower extremities Following rescue some of

so that operation can be delayed till an optimum stage in his resuscitation has been reached but once the intraperitoneal rupture has been repaired improvement can sometimes be dramatic

GENERAL PRINCIPLES OF OPERATIVE TECHNIQUE

In most cases it is best to explore the abdomen through a paramedian incision after debridement of the wound of entry rather than to enlarge the latter and to carry out the operation through this approach A paramedian incision permits the complete examination of all the abdominal contents without difficulty whereas this essential exploration may well be hampered by an incision the position of which is dictated by the site of the wound Where a disruptive entry wound of the lower part of the chest has laid open the pleural cavity however it is best to enlarge this after wound debridement and by cutting across the costal margin to convert it into a thoraco abdominal incision for the purpose of the exploration Intrathoracic injuries may then be dealt with through the same incision as the intraperitoneal lesion

It will be appreciated that in intraperitoneal wounds multiple injuries are often present so that in addition to one or more ruptures of the colon perforations of the small intestine or damage to the solid viscera may well co-exist The small bowel must always be examined first and if injuries are present these should be dealt with before searching the large intestine and treating any ruptures that may be found therein To explore the colon efficiently the small intestines must be packed off and if one or more perforations are present and have not been repaired spilling of the fluid intestinal content with resultant severe peritoneal soiling is almost certain

If the site of the injury in the colon is such that exterioration of the damaged bowel will not give rise to gross fluid loss to the patient the ruptured colon should be brought out on to abdominal surface as a colostomy whenever possible If the perforation of the bowel wall is minute this general principle of treatment may sometimes be disregarded and the lesion may be oversewn by a series of sero muscular sutures Nevertheless if this course is decided upon the sutured puncture wound must be covered with tags of omentum or of the fatty appendices epiploicae and where the site of the injury makes such a manoeuvre possible it should be extraperitonealised and a drainage tube passed down to the area of repair If leakage does then occur the faeces will discharge on to the surface of the abdomen and not disastrously into the intraperitoneal cavity

The conversion of most wounds of the colon into a colostomy is necessary because the wall of the colon around the site of a rupture of more than pin head dimensions is usually bruised to an extent not always apparent at the time of operation Moreover a highly heated fragment of metal may have caused necrosis of the wall around its point of entry The infective nature of the faecal content of the large bowel makes it probable that in the post operative period infection of the damaged wall will ensue If simple suture

Probing of an entry wound should only be carried out when the surgeon is still uncertain about the diagnosis for infection may be introduced into its deeper layers by this manoeuvre However in circumstances of doubt this slight risk must be accepted The track taken by a small missile in passing through the layers of the abdominal wall usually seals itself off quickly so that it may be quite impossible to follow it with a probe but in others the depth to which the guide may be passed without any undue pressure and its direction indicates that it must have entered the peritoneal cavity and that operation is essential

Where the injury is the result of blast or of a blow the same abdominal examinations with the exception of the last are necessary in formulating an opinion and where doubt is still present it is only the frequent observation of the patient and the recording of slight changes in the physical signs that will enable the certain diagnosis of a perforation of the bowel to be made at the earliest possible time

If available a **straight X ray of the abdomen** may localise a missile to the peritoneal cavity and exploration is then essential even though signs of an intraperitoneal rupture are minimal or absent

Pre operative Treatment Anti tetanus serum penicillin and streptomycin are given as soon as the patient is first seen and where the diagnosis is certain morphia is administered Blood transfusion may be necessary in the forward receiving unit and it is often desirable that this should be continued during the stage of evacuation in war time to a surgical centre

If there is an abdominal wound the skin surrounding it is gently cleaned with normal saline No attempt must be made to cleanse the eviscerated bowel or to return it to the intraperitoneal cavity as adhesions which have already formed may be disturbed and infection spread rather than prevented As a first aid dressing it is best to sprinkle the wound and the extruded bowel lightly with penicillin and sulphonamide powder subsequently covering both with lint soaked in normal saline and bandaging the patient s abdomen with a many tailed bandage Warmth sustained by blankets and by hot water bottles is essential during evacuation

On admission to a surgical centre the patient is taken to the resuscitation ward where the blood pressure is recorded and treatment for shock com menced The initial reading of the blood pressure is of great importance as with resuscitation it steadily rises in most patients Operation should be delayed where progressive improvement is being maintained until a minimum blood pressure of 100 mm systolic and 60 mm diastolic has been achieved

In those cases in which peritoneal contamination is gross the return of the blood pressure towards normal limits does not occur It is then no use continuing blood transfusions and other resuscitative measures and the sooner the patient is operated upon the better will be his chances of survival These will not be favourable compared with those of the patient whose blood pressure is steadily rising and whose general condition is correspondingly improving

disruption does occur the discharge is very much less than with a caecostomy or ascending colon colostomy and as the wound in the large intestine is extra peritonealised there is no danger of intraperitoneal leakage

To extraperitonealise this part of the large intestine after its perforation has been oversewn through the abdominal exploratory incision a separate skin incision is made over it the muscles being divided in the direction of the skin cut The peritoneum is now incised and after mobilising the injured

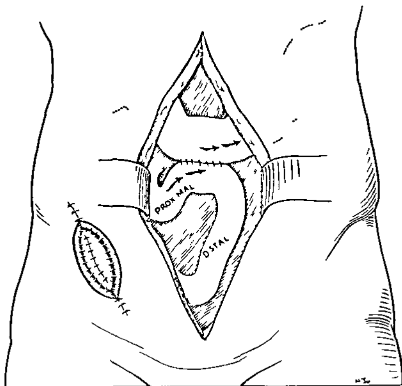


Fig 141
Diagram to show the method of treatment of a wound of the caecum or ascending colon The wound in the bowel has been oversewn and exteriorised An ileo transverse colostomy has been carried out to divert the faecal flow away from the site of the injury

bowel it is drawn out on to the surface of the abdomen through this wound The peritoneum is then accurately sutured to the damaged bowel so that the line of suture surrounds this region The latter is thus completely isolated from the general peritoneal cavity A drainage tube is passed down to this area and the wound is very loosely closed

In wounds in which so great a disruption of the bowel wall has occurred that resection is necessary a formal right hemicolectomy must be undertaken Whilst this operation opens up further retroperitoneal spaces in which infection can result it is to be preferred to any form of exteriorising operation

of the rent alone has been carried out this is then extremely likely to break down with resulting peritonitis

If multiple wounds of the same region of the colon are present it may be possible to exteriorise them in the same colostomy loop Where two areas of damage are widely separated as for example in one of our cases in which perforations of the transverse colon and of the pelvic colon were present both ruptures can be individually converted into colostomies Sometimes the disruption of a part of the colon may be so great or its vascular supply so damaged by the missile that resection will have to be undertaken The mortality associated with such resections in battle casualties is high but mainly on account of the severity of the initial injury and of the gross peritoneal contamination that results from the widespread presence of free faecal material in the intra peritoneal cavity After the disrupted region has been excised no attempt is made to restore continuity except in injuries of the caecum or of the ascending colon and the proximal and distal ends are brought out on to the surface of the abdomen at the most convenient sites In such injuries we consider it inadvisable to attempt to double barrel the two ends of the colon except perhaps in some wounds of the transverse or pelvic colon Such a procedure takes additional operative time and may well entail considerable mobilisation of the bowel both of which factors are contraindicated in the severely ill patient and in one in whom infection is already widespread if they can be avoided The problem of restoring continuity should be left until the patient is fully recovered when it is not a difficult one

Where a haematoma of the wall of the colon is discovered during the exploration of the abdomen it should be oversewn and covered with omentum

OPERATIVE DETAIL

Rupture of the Caecum or Ascending Colon In conformity with the principle of exteriorisation of open wounds of the large intestine gunshot injuries of this region were treated in the initial phases of the last war by such methods In battle conditions the maintenance of hydration of a patient discharging fluid faeces from such caecostomy or colostomy was difficult and the discomfort and despair of the patient who in addition to being called upon to endure often a multiplicity of wounds was required to tolerate this added burden induced surgeons to consider other methods of treatment The author was amongst those who suggested that in such lesions the wound in the caecum or ascending colon should be oversewn and extraperitonealised with drainage down to the site of the suture In order to bypass the faecal flow away from the wound an ileo transverse colostomy was advised This method carried out in practice proved infinitely preferable to simple exteriorisation in the treatment of these injuries (Fig 141)

The ileo transverse colostomy serves to short circuit a large proportion of the intestinal content away from the damaged caecum or colon so that the possibility of the sutured wound in the bowel breaking down is reduced When

diaphragm is repaired and the wound closed the pleural cavity being drained by a closed drainage method

Rupture of the Descending Colon It is usually impossible to mobilise this portion of the large intestine to an extent sufficient to allow the injured area to be exteriorised completely Nevertheless it is often feasible to extra peritonealise the ruptured area through a stab incision in the left loin in the same way as is described in dealing with wounds of the caecum (Fig 142)

In the fat subject with a particularly fixed colon even this measure is impossible In such cases it is best to oversew the rupture and to reinforce the suture line with the appendices epiploicae and with omentum the faecal stream being interrupted by instituting a transverse colostomy The site of the suture is drained through a stab wound in the flank

If the descending colon is grossly disrupted excision of the region must be undertaken This entails mobilisation of the splenic flexure the upper line of section of the bowel being made through the distal transverse colon The free end of the latter is exteriorised The lower line of section is made through the upper part of the pelvic colon its free end being exteriorised similarly through an incision made in the left iliac fossa As explained above no attempt should be made to double barrel the two ends of the colon with a view to facilitating the subsequent restoration of continuity

Rupture of the Pelvic Colon Injuries involving the upper part of the pelvic colon are treated by exteriorisation of the damaged region as a colos tomy A rupture of its lowest part by nature of its position cannot be exteriorised or brought out to the peritoneal level of the lateral abdominal wall and can therefore only be treated by suture with reinforcement by omentum or appendices epiploicae A large drainage tube is passed down to the site of injury through a suprapubic wound or through the lowest part of the paramedian incision and a pelvic colostomy is made to divert the faecal flow from the damaged bowel

We consider that the latter is preferable to a transverse colostomy for the following reason The colons in these injured patients are often full of faecal material If a transverse colostomy is made a large quantity of faeces will thus pass over the line of suture in the pelvic colon soon after peristalsis has returned in the post-operative phase This is far more likely to produce the breakdown of the repaired rupture than the small amount requiring evacua tion that is contained in the bowel below the level of a low pelvic colostomy

The tube draining the site of suture in the pelvic colon should always be brought out through the suprapubic region and not through a stab wound in the left iliac fossa The former route provides for more direct drainage and if the suture line does break down and does discharge faeces these will escape through the relatively short track In the event of a leakage with drainage instituted in the left iliac fossa free discharge of the faeces through this site is less certain and the danger of a general peritonitis is therefore all the greater

Rupture of the Hepatic Flexure or Transverse Colon At the level of the hepatic flexure the fluidity of the faeces is considerably reduced so that in wounds of this region the bowel can be exteriorised without the disadvantages attendant upon exteriorisation at a higher level Mobilisation is simple following division of the peritoneum of the upper part of the paracolic gutter and that on the superior surface of the flexure The injured bowel is best exteriorised through a separate wound in the subcostal region

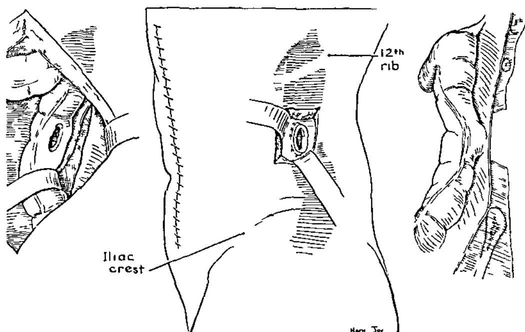


FIG 142

Extraperitoneal exteriorisation of a wound of the descending colon
(a) Mobilisation of the colon
(b) Exteriorisation of the bowel through a separate incision in the loin The peritoneum is closely sutured around the rent in the colon
(c) Diagrammatic view of the exteriorised colon

A wound of the transverse colon is also best brought out through a separate incision made over the site of the injury though where the patient is severely ill exteriorisation through the upper end of the main incision is quicker Some mobilisation of the splenic flexure and upper part of the descending colon may be necessary to achieve sufficient mobility of the distal portion of this part of the large bowel to permit its reaching the anterior abdominal wall

Rupture of the Splenic Flexure *Injuries to this region mainly follow a gunshot wound which has entered the body through the lower part of the thorax and which in its course has penetrated the pleural cavity and the diaphragm The rupture will therefore usually be exposed through a thoraco abdominal incision*

The flexure is mobilised in the usual way and is exteriorised as a colostomy through a separate stab wound made below the costal margin The

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Post operative Treatment This is similar to that discussed in Chapter IX Subsequent restoration of continuity of the intestinal track in those cases in which two colostomies have been established following excision of a portion of the colon presents no great difficulties The two ends are separated from the abdominal wall and following re-opening of the abdomen and subsequent mobilisation they are trimmed and a direct end to-end anastomosis carried out

Extraperitoneal Wounds of the Large Intestine By virtue of their anatomical situation and the absence of a meso-colon these affect the caecum and ascending and descending colons only The presence of such an injury may be made very obvious particularly in the right side of the colon by the presence of faecal material pouring from the wound in a patient who shows no sign of an intraperitoneal lesion In other cases the penetration into the bowel may only be revealed on exploration of the wound of entry

In all such injuries the wound overlying the bowel must be enlarged in order to provide free drainage so that loculation of the faeces with the associ ated danger of spreading retroperitoneal infection is avoided In forward units further operative treatment is not indicated but at a base unit should the faecal leak be severe and should it show no signs of lessening a diversion of the faecal stream is required In lesions involving the right side of the colon an ileo transverse colostomy will be necessary and in those of the left side a transverse colostomy

Should the fistula persist after an interval of several weeks direct closure of the perforation must be undertaken after full preparation of the bowel

Cases are occasionally seen in warfare in which the entry wound has sealed itself off and the faeces have tracked extensively into the extraperi toneal tissues The patient is then severely ill as a result of the accompanying retroperitoneal cellulitis This region must be widely drained by enlargement of the entry wound and a diversion of the faecal stream carried out

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